WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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WORK WORLD.

A VALUABLE bed of coal has just been traced at Ashton-under-Lyne, which is estimated to yield over 230,000,000 tons.

* *

In one day the human body generates enough heat to melt forty pounds of ice and raise it to boiling heat. A marvellous machine this human frame!

* *

A scheme for amalgamating all the building trades in Philadelphia makes progress. The idea is to avoid strikes, and more agreement between employers and employed.

* *

Wood properly treated may be moulded in blocks in the shape of bricks. A hotel built in Hamburg entirely of compressed wood is as hard as iron, and rendered absolutely proof against fire and the attack of insects by chemical processes.

* *

Krupp, of Germany, will exhibit at the World's Fair the biggest cannon ever constructed. It will weigh 122 tons. The special car on which the cannon will be shipped will itself weigh nearly 20 tons, so that almost 142 tons will be comprised in a single load.

* *

At last the dry collodion process plates are on the market. The advantages which they possess cannot be disputed:—a clear glass in the shadows, suitableness for lantern slides, fine results in copying, freedom from halation, and rapidity in the developing and washing processes.

* *

An idea is on foot for a trial of speed of English and American locomotives between New York and Chicago during the Columbian Exposition. The plan is to bring over an English engine of the latest pattern, with fuel and crew included, so that the test may be fair. Given equal conditions, we believe the English would win on all points—easily.

* *

"Sand Cement," made by mixing hydraulic cement with sand, gravel, or ballast, has been patented. The idea of "hydraulic" cement is novel. We know of cements that resist the action of water—all limes that burn buff colour do this; the best is the barrow lime of Leicester—but water-pipes made of cement would be new to us. Where was the inventor's adviser?

* *

Diving dresses in the pearl fisheries of Tahiti are to be abolished, as being injurious to the interests of the natives who depend upon that industry for their living. It is also considered unadvisable to fish at greater depths than ten fathoms, as beyond that the shells are mostly important for reproduction, and to destroy them will be to ruin the fisheries.

* *

In an electric arc the positive pole is hotter than the negative, the positive showing a temperature of about 4,000° C., the negative showing a temperature of 3,000° to 3,500° C. This difference of temperature produces a counter electromotive force which acts like ohmic resistance. The cause of the positive pole wearing away twice as fast as the negative is due to this difference in temperature.

* *

Some trials of anti-fouling paints upon English warships show that a French composition introduced by our Naval Attaché at Paris is likely to be largely adopted. It was applied to the hull of the *Camperdown*, which vessel, when recently docked at Portsmouth, after a ten months' cruise as flagship of the Channel Fleet, presented an exceptionally clean and satisfactory appearance. The composition is to be again applied to the vessel.

* *

In a new pneumatic tool for caulking the joints of steam boilers, a chisel edge is given a rapid reciprocating motion by the action of a small piston driven by compressed air. Held in one hand, the instrument requires little pressure to keep it to its work. Some hundreds of blows are struck per minute. One feature of the appliance is that it can be used in awkward places where it is difficult to use the ordinary hammer and caulking tool.

* *

The lifting of a railway station has been accomplished at Frodsham, in Cheshire. The station being too small for the joint lines running into it, and in order to obtain increased platform accommodation, it was decided to remove the station-master's house, booking-office, and general waiting-rooms about 6 ft. back. With the aid of eleven powerful jacks, the whole erection, weighing about 400 tons, was moved *en bloc* into its new position. A cracked chimney stack only marred the operation.

* *

Engineers, when letting eccentric straps together, should have a trammel gauge or piece of $\frac{1}{4}$ in. wire turned down at each end and sharpened at the points. When the engine is in good order a centre mark should be made on the stuffing-box, and another on the slide-rod or eccentric-rod, then make the trammel gauge to suit this distance when the engine is on one of its dead centres. This will save time; the slide-valve can be lined up, without breaking the joint of the steam-chest cover, by placing liners at the foot of the eccentric-rod.

* *

An instrument for testing the magnetic properties of iron and steel has been invented. An aluminium wire, 30 in. long, suspended vertically by a wire, carries at the top a magnet fixed at right angles thereto. The lower end carries a light fork, across which a fibre is stretched to carry a mirror at right angles to itself. The specimen of iron is placed in a magnetising coil near the mirror, and the current also passes through a coil placed near the upper magnet. The motion of the mirror is observed by the aid of a spot of light which, as the current is varied, traces out curves of magnetic variation.

* *

Temperatures in deep borings in America are interesting. One boring, 5 in. in diameter and 4,500 ft. deep, lined with iron pipe, was dry except where water had accumulated at the bottom. It was found that the temperature became higher by about 1° Fahr. for every 82 ft. increase of depth. As the boring was continued, the increase of temperature became somewhat higher; at a depth of 4,462 ft. it was 110·15° Fahr., that at the surface being 51°. No law can be formulated on the subject, because the crust of the earth is not homogeneous. In the instance cited the fact of the bore-hole being lined with iron may have rendered the thermometer readings inaccurate.

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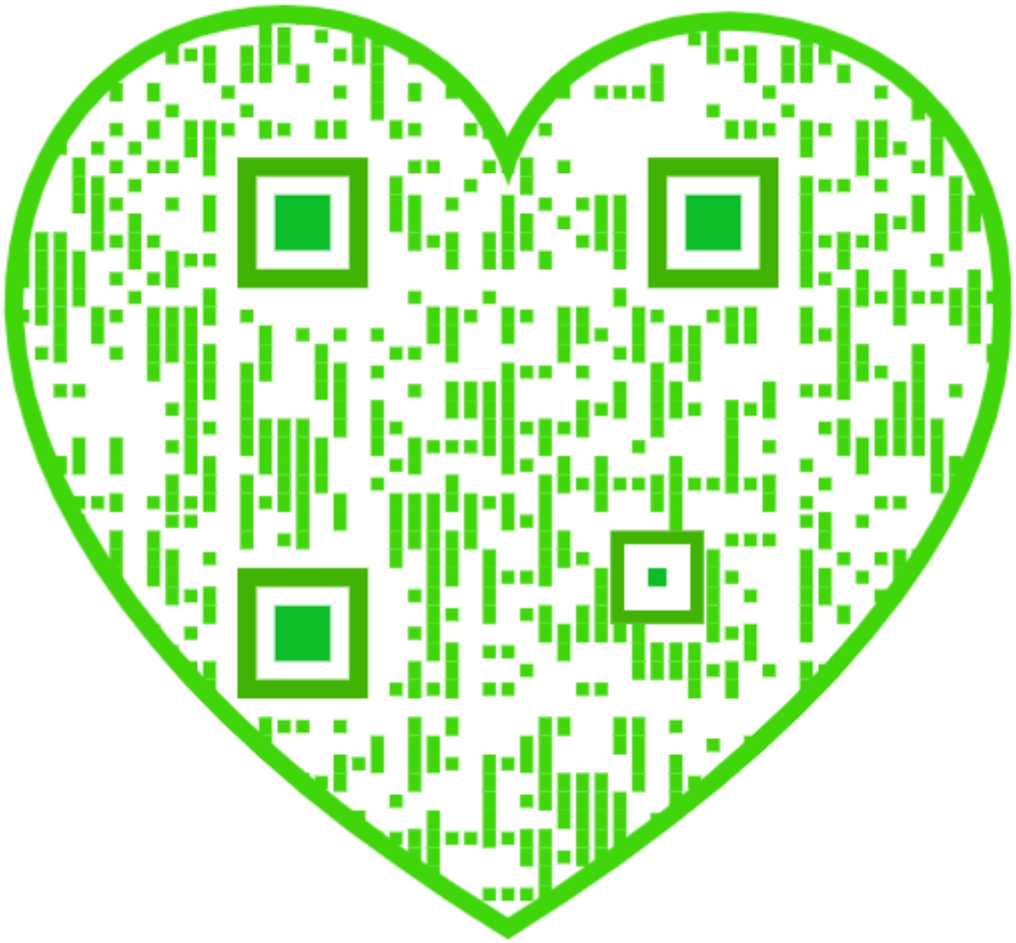

JEWELLERS' ENAMEL AND ENAMELLING.

BY H. S. GOLDSMITH.

EXTRACT FROM SYLLABUS OF THE CITY AND GUILDS OF LONDON INSTITUTE FOR THE ADVANCEMENT OF TECHNICAL EDUCATION—DEFINITION OF AN ENAMEL: ITS QUALITIES AND USES—CLASSES OF ORNAMENTAL ENAMEL—CHAMP-LEVÉ, CLOISONNÉ, AND ENAMEL PAINTING, ILLUSTRATED BY DIAGRAMS AND EXAMPLES OF HOLBEIN WORK—JEYPORE ENAMELS—FRENCH CLOISONNÉ.

THESE short papers were written as an attempt at giving such information to the students of the ordinary grade of goldsmiths' work as would be useful to them in the course of their business, as well as in their examination for prizes and certificates next May, and to deal with matters not spoken of in their text-books.

In the syllabus issued by the "City and Guilds of London Institute for the Advancement of Technical Education" the subject is mentioned in these words:—"Enamelling. — Difference between champ-levé, cloisonné, and enamel painting, with some account of their principles and practice."

The writer asks leave to state that the following remarks will not be strictly and rigorously held within such bounds as may seem to be defined in the above quotation; for liberty has been taken to refer to other—but, it is hoped, not irrelevant—matters.

Definition of an Enamel.—Enamelling—at any rate, for jewellers—can be defined as an opaque or transparent *vitreous glaze* fused to a *metallic* surface. It is used by goldsmiths to embellish jewellery, by giving variety of colour and surface to the different ornaments; and it is used by other trades for other purposes: from enamelling a street-sign or the number of a cab to lining a saucepan. With us it is employed mainly for its artistic qualities, on account of the many beautiful colours it can give us; with others, its more prosaic, but not the less valuable, qualities of permanence and non-corrosiveness are more valued, as the readers of WORK well know.

Classes of Enamel Work.—The first two terms made use of in the extract from the "City and Guilds' Syllabus" are *champ-levé* and *cloisonné*. These are the names of two classes into which enamels are divided, but they refer entirely to the way in which the work *is prepared for the reception of the enamel* (Fig. 1, A, B, and C C′, and Fig. 2, A, show them in their simplest form), while enamel painting deals *with the surface only* of an already prepared enamel plaque (shown diagramatically in Fig. 3).

Enamel Painting is a process in itself very much like water-colour painting: the colours are laid on in a powdered condition with a volatile oil, just as water-colours may be laid on paper with water as a vehicle. The difference is that enamel colours are fixed, and to a great extent *developed*, by fire, while water-colours undergo no further development. More will be said on this subject later on.

It being understood that enamel painting has to do with the surface of a piece of enamel, and that the two terms champ-levé and cloisonné have to do only with the form of the supporting material, it follows that an enamel painting may be a cloisonné or a champ-levé enamel as well as an enamel painting: not that enamel paintings are, as a rule, done on plates prepared *à la cloisonné*, but on a plaque of gold or copper, encrusted with two qualities of enamel under certain defined conditions.

The two French terms *champ-levé* and *cloisonné* seem to ask for an explanation of their meaning. Champ-levé means that the ground or field which is to support the enamel is either chased into hollows, if the metal is thin (Fig. 1, B), or has hollows dug out if the metal is stout enough (Fig. 1, A); the hollows or grooves being, of course, made of the desired pattern that the enamel is to take.

Champ-levé enamels, then, will be those where the surface of the article is altered to a suitable condition to receive the enamel, either by the formation of grooves, hollows, or shelves; and the same name is given to enamel work even when the article is quite, or only partially, enclosed in enamel (Fig. 1, C, etc.), this last mentioned being more often called the Cinque-cento or Cellini style when applied to boldly-modelled ornament. It is well shown in several enamel articles in the South Kensington Museum, but particularly in a book-cover or case for a missal said to have belonged to Henrietta Maria, Queen of Charles I. (No. 736.64). It is at present in the Prince Consort's Gallery, where also is the small cup we shall shortly refer to.

All the parts of Fig. 1 are mere diagrams, to illustrate the variations in their simplest possible forms.

Holbein Style of Enamel.—Of the two more ordinary varieties of champ-levé three examples can be shown. Fig. 1, A′, is a copy from some genuine designs of Holbein; and if it were made up in what we call the Holbein style, the varied pattern would be brought out in many different colours of enamel: such as green, red, white, black, and blue.

A genuine sketch has been preferred for evident reasons, but it would hardly be fair to pass over the modern Holbein work, in which stones in raised settings are alternated with a severe and ugly form (as shown in Fig. 1, A″.)

This shape is more or less toned down by varying the colours of the enamels in the five partitions, and would probably have a few scrolls running from it. The scrolls might be gold and the ground black; but there is nothing fixed with regard to this class of work, except that a good contrast of enamel colours and of gold was to be attained.

The plate to form the article would be either flat or in some simple raised form; the enamels would be run into hollows that were engraved out, and the whole of the enamel polished off quite smooth, this being in complete contrast to the raised or Cinque-cento style, shown in its simplest form in Fig. 1, C.

Indian (Jeypore) Enamel.—For an example of champ-levé, where the ground is chased into hollows, the best example is Indian work.

The sketch, Fig. 1, B′, is the back view of part of a necklace, two squares out of sixteen, with pearls connecting them. The colours would most probably be crimson for the flowers and green for the leaves. There are dozens of examples of this sort of work in the Indian section of the South Kensington Museum, and they are to be met with in nearly all art collections.

The gold used is very nearly pure, and is extremely thin. The purity, combined with

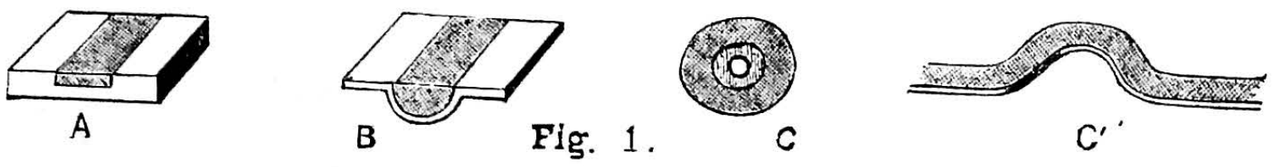

Fig. 1.

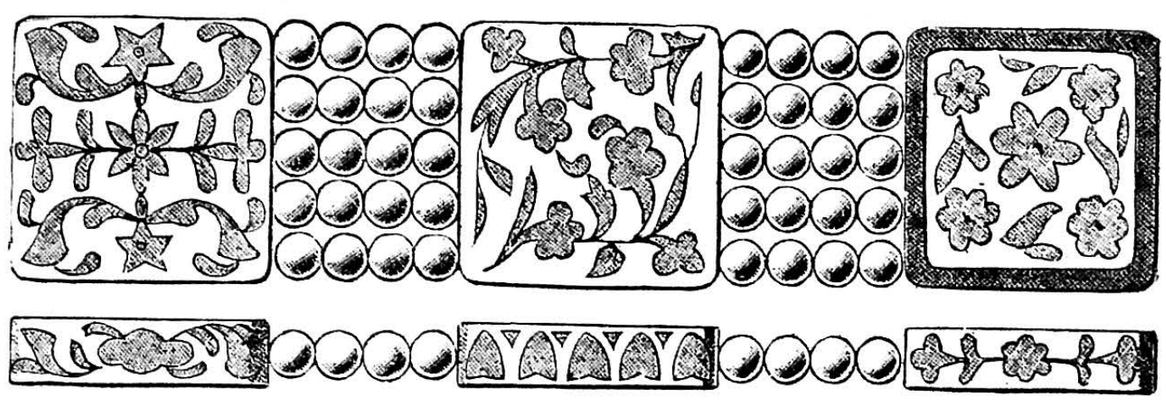
Fig. 1 B′

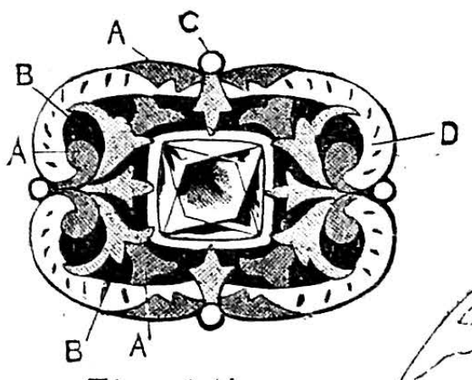

Fig. 1 A′

Fig. 1 A″

Fig 2B

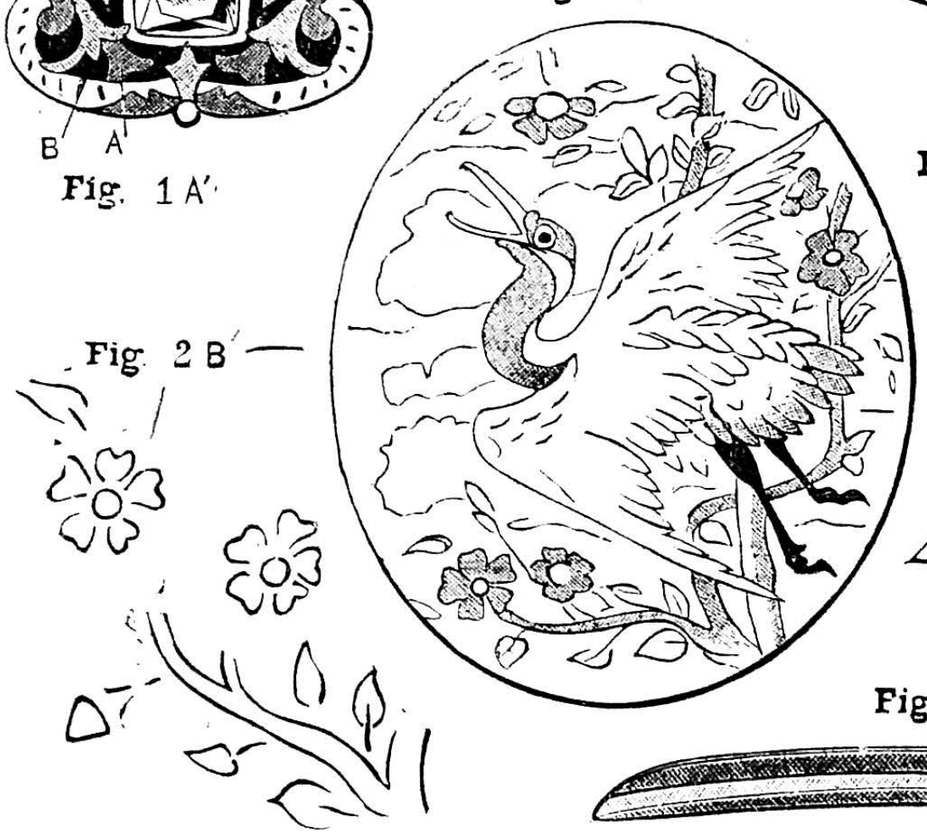
Fig. 2 B′

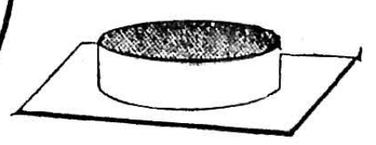
Fig. 2 A

Fig. 3.

Jewellers' Enamel and Enamelling. Fig. 1.—A, Simplest Form of Champ-levé Enamel—*i.e.*, with hollow cut out; A′, as applied in an Enamel Brooch of Holbein; A″, as applied in the Modern Holbein Work; B, Another Form of Champ-levé, where the Metal is chased into Hollows of the desired Shape; B′, as applied in Indian Work: the sketch is taken from part of a Necklace; C, C′, a Third Form of Champ-levé, the Enamel encrusting or enclosing the Metal, either partly or entirely. Fig. 2.—A, Simplest Type of Cloisonné Enamel—a Cloison filled with Enamel; B, Drawing of a French Cloisonné Plaque; B′, Lowest Branch of same, showing how Wires or Ribbons are shaped to form Cloisons and the Number of Pieces (Thirty-three). Fig. 3.—Section of an Enamel Painted Plaque—1st Top thin dark Layer represents Enamel Paint; 2nd Layer is the Enamel Ground; 3rd, Metal; 4th, Enamel for strengthening purposes.

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its tenuity, of course greatly facilitates the formation of the different-shaped hollows, and also brings out the enamel colours in their highest degree; but being too weak for wear, it is always filled in with a pitch-like substance before the stones are set in.

Cloisonné (or in cells).—This term comes from the French word, "cloison" (a partition wall); and, as one would expect, for this class of work the surface is divided into separate parts by soldering properly shaped partitions or ribbons at right angles to the surface, so that different enclosures are formed. This is sometimes called filigree enamel, or Byzantine style. Into these enclosures, or "cloisons," the enamel is fused.

The best examples of modern cloisonné are produced by the Japanese and the French, the latter using it for jewellery to a great extent, and the former for many other articles, vases included; and on some of the vases the work is even finer than the French put on their jewellery, fine as that is.

The finished example given here (Fig. 2, B) is sketched from a series of four stages, showing (1) the design, (2) the gold plate with cloisons soldered on, (3) first stage of enamelling, (4) the finished article. These were presented to the South Kensington Museum by Monsieur A. Falaize, aîné, and are numbered 1772 to 1772c.—69. They are at present in the Western Galleries, where most of the modern jewellery is.

To give a clear idea of the number of pieces that go to make up a cloisonné enamel, the lowest branch is here shown (Fig. 2, B') separated, and thirty-three pieces are in that portion alone. The full number can be counted by anybody curious in the matter, and possessed of sufficient patience to make a pilgrimage for that purpose to the Museum.

The finest examples of Japanese cloisonné are now seen in the shop window of Messrs. Halstaff & Hannaford, Regent Street, W. The jars are decorated with a minuteness and refinement almost incredible.

These two classes of enamel work—champ-levé and cloisonné—have both the same practical object in view, which is the formation of cells to keep the colours separated and to protect the enamel, by giving depth to obtain a firm hold, as well as to guard it from risk of danger by blows on its thin edges. Depth is also required to obtain richness of colour in many cases. Less depth is required than would be thought necessary by most people; but slight as it is, it does away with the extremely thin and weak edge that an enamel would naturally have if left in the condition that it would take after being fused.

Cloisons.—The partitions (Fig. 2) which give the name to the cloisonné enamel are not always made of *flat* pieces soldered at right angles to the work. The cloisons are still cloisons even if round or twisted wire is used to form the partitions; and so that the enclosed spaces, the cells, or the compartments for the reception of the enamel are placed *on* and fixed *to* the work, it will belong to the "cloisonné" style; while if the base *itself* be prepared by cutting a portion out, or by being chased into hollows, or is enclosed in enamel, then the title "champ-levé" will belong to it.

The next paper will deal with the more uncommon varieties—with false enamels and niello; the third with the preparation of work for enamel; the fourth with the process of enamelling.

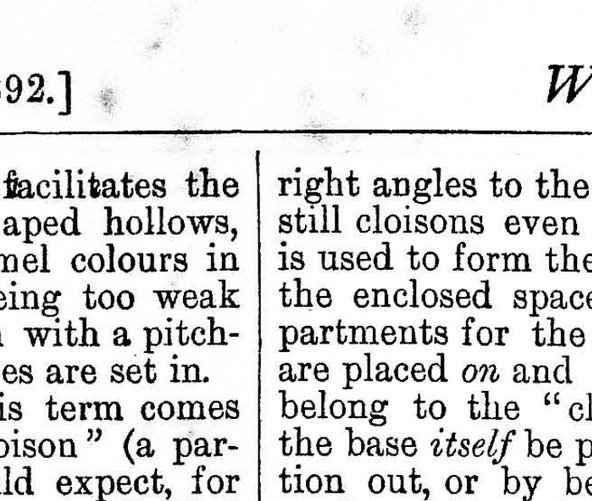

Fig. 4

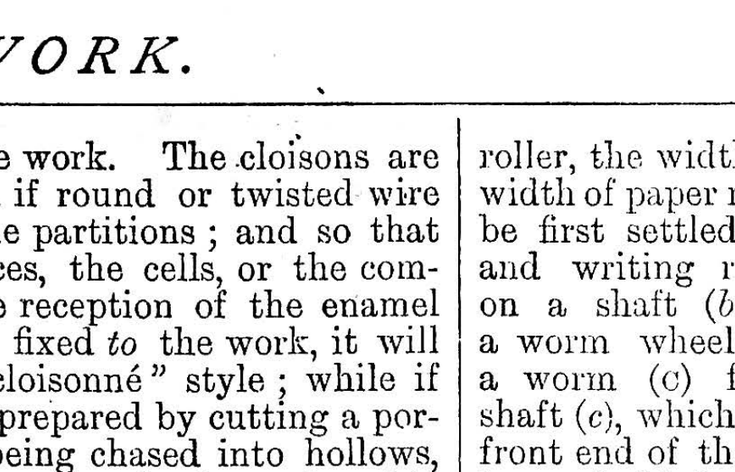

Fig. 2

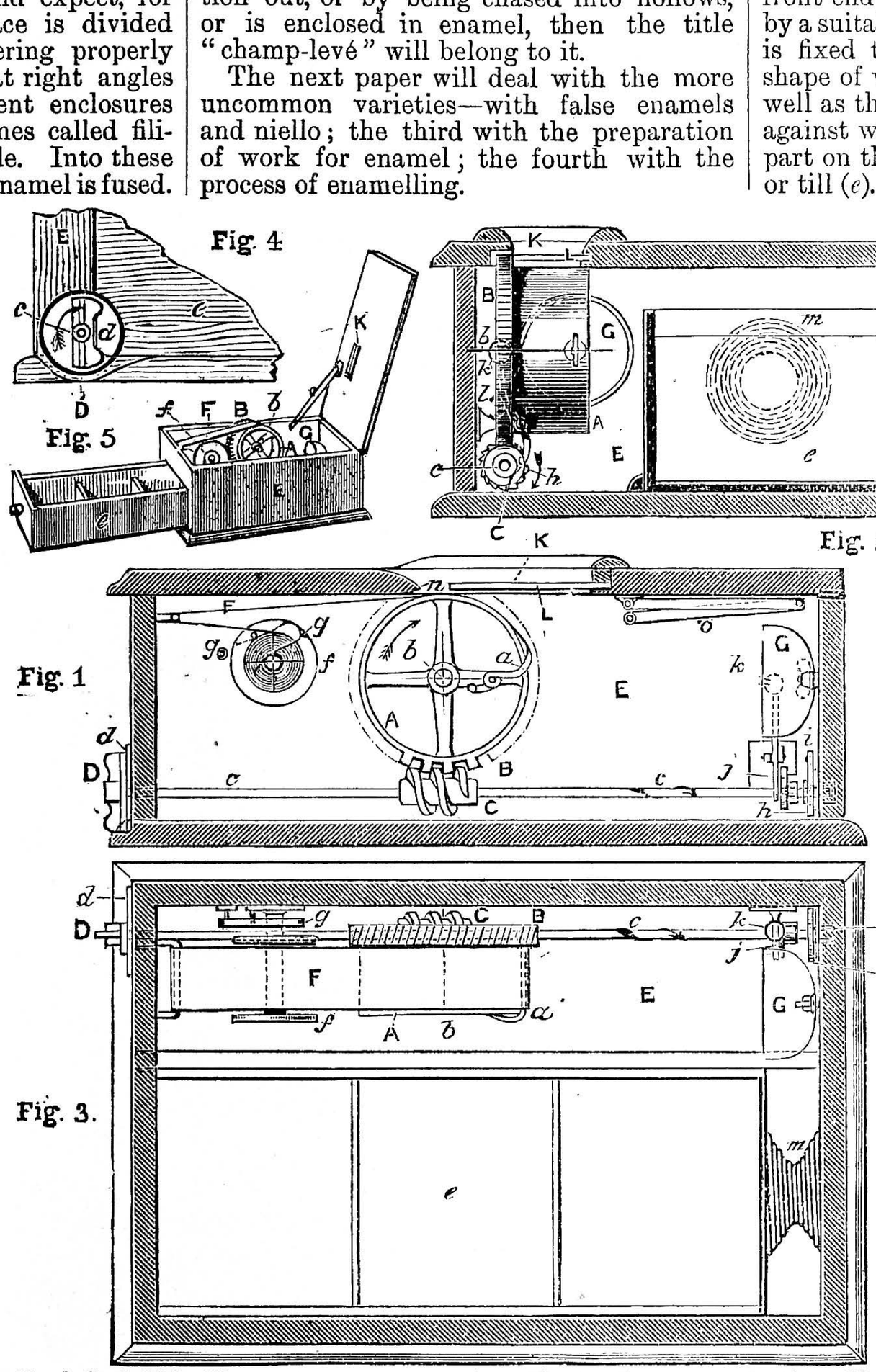

Fig. 3.

Check Cash Till. Fig. 1.—Sectional Elevation. Fig. 2.—Transverse Section. Fig. 3.—Plan, Lid removed. Fig. 4.—Front View, showing Handle for working Mechanism. Fig. 5.—Perspective View, showing Till and Top open.

TRADESMAN'S CHECK CASH TILL.

BY P. B. H.

THERE are several kinds of tills in use to prevent robbery by assistants. The principle is, however, somewhat the same in all: so I will, with the above drawings, describe the interior arrangements of one of the many. I may here say that most of these machines are patented, but I have no doubt one could alter the mechanism and arrangement to overcome the difficulty. The drawings herewith respectively numbered 1 to 5 will give a clear idea of the mechanism by which check tills are worked. A is a turned metal hollow roller about 5½ in. diameter, round which the paper for the accounts is gradually wrapped, and to which it is first held by means of a small spring clip (*a*) fastened to one of the arms. This roller, the width of which depends on the width of paper required—which latter should be first settled by the quantity of figures and writing required in one line—turns on a shaft (*b*), to which is also fixed a worm wheel (B), driven by means of a worm (C) fastened to a longitudinal shaft (*c*), which latter projects through the front end of the till, and is carried therein by a suitable bearing. On this projecting end is fixed the brass polished handle (D), the shape of which can be best seen in Fig. 4, as well as the brass circular segment plate (*d*) against which it works, and which is fixed, part on the box (E) and part on the drawer or till (*e*). The worm (C) should be single-threaded, and the pitch should, in this case, where the worm wheel and cylinder are almost of the same diameter, equal the space between two lines of figures, so that with each revolution of the shaft (*c*) the worm wheel, together with the cylinder (A), will have turned through a space equal to the space between two lines of accounts. The paper (F) is carried rolled on a wooden bobbin (*f*), which latter is prevented from unwinding too quickly by the spring (*g*) bearing on the lengthened end, and this spring should be carefully adjusted, so that the tension on the paper should be neither too great nor too little. I may here remark that the shaft (*c*) must not be turned backwards, therefore on this shaft, at the back of the box, I have fixed a ratchet wheel (*h*) and ratchet (*i*), kept in position by a small spring.

The bell (G) is rung by means of a cam (*j*) on shaft (*c*); this cam (*j*) gradually moves the hammer (*k*) of the bell till the shaft (*c*) has revolved a quarter of a circle to the right from its present position, when the hammer (*k*) is driven against the bell by means of the spring (*l*). The drawing, I think, without more explanation, shows the mechanism clearly. The handle (D) for working the internal mechanism is of the shape shown in Fig. 4—that is, there are two ears on the right-hand side; this only allows the till (*e*) to be opened in one position for each revolution of the shaft (*c*), and that is when the handle (D) has performed one-half of a revolution from its present position, or until the straight side comes next the till (*e*), when, by means of a coiled spring (*m*) fixed to the back of the casing, the till (*e*) is forced out, and when the change has been taken out the till is replaced, and the handle (D) made to complete its revolution.

An opening (K) is cut in the top of the box, and glass (L) inserted, a small slot (*n*) being left the full width of the paper, so that the figures can be entered on the paper. The small rods (*o*) are to prevent the lid opening too far. The methods of carrying the various parts I have left to your own taste, and even the mechanism could be altered to suit anything you might have at hand. In order,

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however, to leave it more to your judgment, I will give you a few directions to assist you when using the till.

A strip of paper (F), ruled to whatever design you require, and long enough to register the transactions occurring in a day, is placed on the reel (*f*), and the end secured by *a*; the lid is then closed and locked. Just before business commences you enter on the paper through the opening (*n*) the amount of change to commence with. You then turn D until the till springs out, so that you are enabled to insert the change. I may say that during this half turn the bell has rung. The till is now closed, and the handle turned into position, as shown on drawing. During this one revolution of the handle the figures written on the paper have been carried under the glass, and though they can be plainly seen, they cannot be altered.

Suppose an article worth 6s. is bought, for which the customer tenders 10s., you first record the amount through the opening (*n*), then turn the handle to the right for a quarter of a revolution, when the bell rings, warning assistants that someone is at the till; another quarter of a revolution, and the till opens, thus enabling you to place the 10s. in and take out the change. You then close the till and turn the handle to position shown, when the figures will have been carried forward, and the paper left ready for another transaction. Suppose the customer had tendered 6s., and an assistant wished to steal it, he must first omit to register it and also to open the till, when the suspicions of some of the people about will be aroused at not hearing the bell sound.

He is a fortunate tradesman whose experience has given him no concern respecting his till. Many an ingenious man ought now to be able to make his own check cash till. Any difficulty could always be remedied in "Shop."

BACHELOR'S BOOKCASE.

BY H. J. MARK.

INTRODUCTION—SIDES—SHELVES—BACK-RAILS—BACK-BOARDING—UPRIGHTS—CUPBOARD-DOOR FRAMES—PANELS—BRACKETS—ENAMELLING AND FINIS.

Introduction.—I have chosen the above title on account of this particular bookcase being especially suitable to the requirements of bachelordom, being neat in appearance and compact, easily and cheaply made, and, above all, being so designed that it can be readily taken to pieces, packed up for transit, and as readily put together again. It will hold between thirty and forty volumes, quite as many as most bachelors care to carry about with them; and now that winter is coming, and a pipe and cheerful fire are two great factors of a bachelor's (or a married man's) comfort, what can be more pleasant than to take some favourite book or periodical from a bookcase, made more enticing by the fact of its being of one's own construction? To my thinking, the book seems to have an additional flavour added to it coming from such a repository than it does from the landlady's rickety shelves, chiffonier, or whatever receptacle it is she provides. It stands, when finished, 4 ft. 1 in. high, 2 ft. 6 in. long, and 1 ft. 3¼ in. deep over all. It is made of deal and mahogany, and is finished in enamel colours and gold—say, Pavitt's Ardenbrite.

Fig. 1

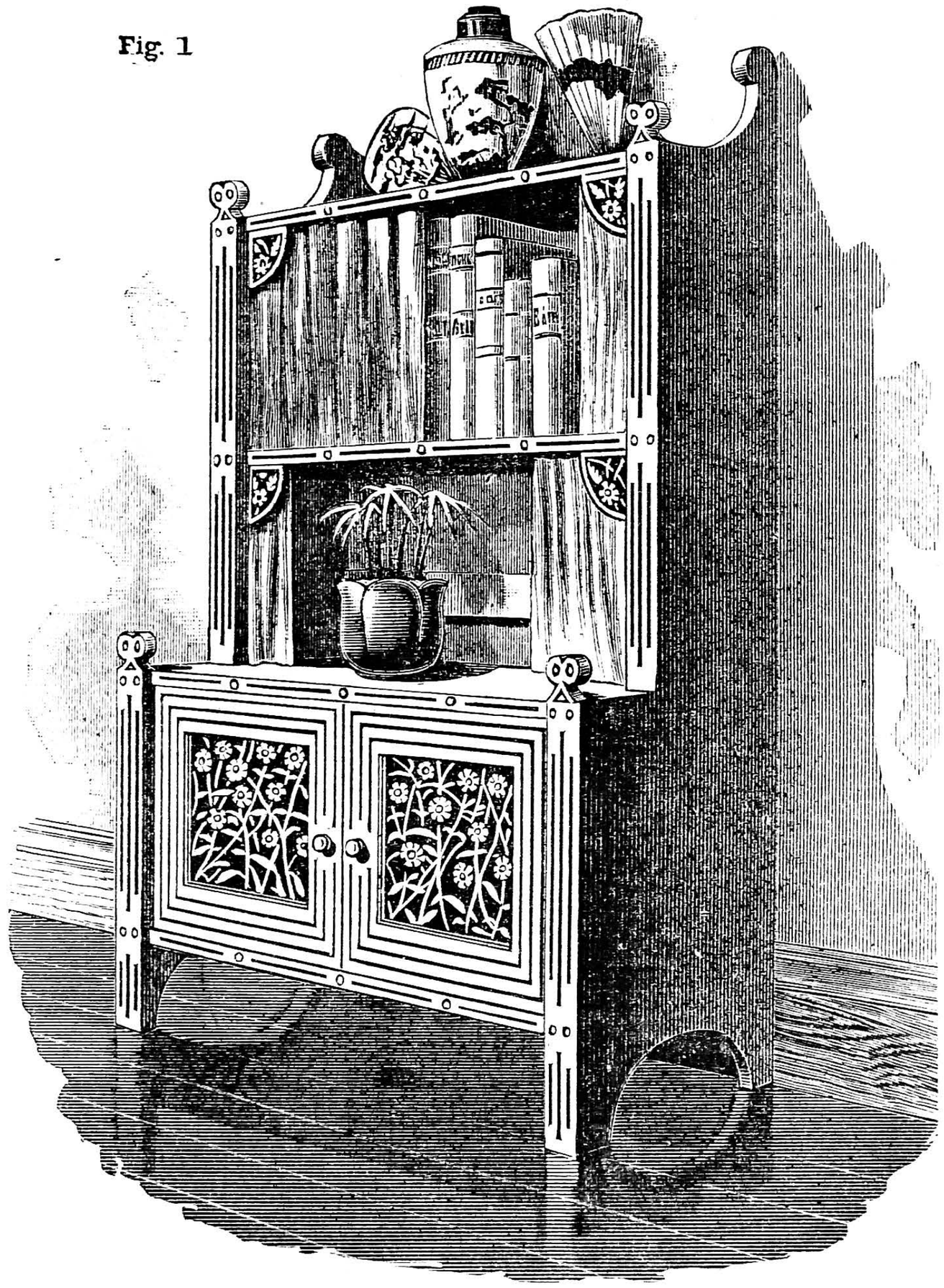

Fig. 1.—Bachelor's Bookcase Complete.

Sides.—The sides are 4 ft. 1 in. high, 1 ft. 2½ in. wide, and 1 in. thick, and preferably are shaped out of one piece of stuff. They are rebated ¼ in. deep for the shelves and ½ in. deep between the two lower shelves, to take the back-boarding of cupboard.

Shelves.—These are 2 ft. 4½ in. long and ¾ in. thick, the top ones being 10⅜ in. wide, and the two bottom 1 ft. 2⅞ in. wide. They are housed into sides, and secured by three round-headed brass screws at each end. They project beyond the sides ⅜ in., and have grooves and sinkings along their fronts, as shown in Fig. 1. The two lower shelves are rebated along their inside edges at back ½ in., to take back-boarding.

Back-rails.—These are 2 ft. 5 in. long, 2 in. wide, and ⅓ in. thick, and are secured, as shown in Fig. 3, by ¾ in. screws, two at each end, to sides.

Back-boarding.—The back-boarding of cupboard is of ½ in. match-boarding, tongued and grooved, and fitted into the rebates of shelves and sides, and secured by ¾ in. screws. If desired, the back-rails could be done away with, and the back-boarding carried up to top shelf.

Uprights.—These are fashioned in the same manner as in a "Whatnot for Amateurs" (No. 128, Aug. 29th, 1891), the projecting ⅜ in. of the shelves being housed into them, as shown in Fig. 7, isometrical detail. They are likewise secured by the same kind of fancy brass-headed nails.

Cupboard-door Frames.—These are 2 in. wide, ¾ in. thick, and 1 ft. by 1 ft. 1 in. over all, and are mitre butt-jointed, as shown in isometrical detail (Fig. 4). The joints are glued and secured by 1 in. screws, care being taken to put in the screws so as they shall enter the thickness of the wood and not penetrate through the grooves; the screws, of course, are screwed in from the inside of door frame. They are rebated ½ in. by ⅓ in., to take fretwork panels, to secure which and keep in place, a fillet 1 in. by ¼ in., mitre-jointed, is put around, as shown in section (Fig. 2). They are hung with one pair of brass hinges each to two pieces of ¾ in. by 1 in. stuff, and 12 in. long, fitted inside cupboard, and secured to uprights. They are also fitted with two small ornamental handles, a cupboard lock, and one small brass flush bolt. Two small pieces of wood, ¼ in. by ⅜ in., should also be placed inside, top and bottom, for them to stop against.

Panels.—These are of ⅛ in. mahogany. The *motif* of the design is that of marguerites, ¾ in. border (see Fig. 6). The panel would look still better if finished by a little relief carving.

Brackets.—These are of ¼ in. mahogany (Fig. 5), drawn half-size, and are secured by ½ in. screws to uprights, the dotted line in the figure being the line of upright. Two are wanted for the right hand and two for the left.

Enamelling.—The wood is stoped in the same way as for the previous articles in WORK, and the main colour is Arabian brown. The uprights are treated as before described. On the edges of the shelves the grooves are blue and the sinkings gold. On the cupboard-door frames the two outer grooves are gold, the middle one blue. The panels—the flowers are white with gold centres; the leaves, various shades of green, according to taste; and the stems bronze-green or olive, with touches of a little brown in more shadowy parts; the brackets, ditto. Behind the panels is placed, tastefully arranged, pea-green pongee silk or other material. The curtains are hung to a small brass rod with what my wife tells me is a "roosh" at the top; they are also

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pea-green, and are for protecting the books from dust, etc.

THE WORSHIPFUL COMPANY OF PLUMBERS.

BY A WORKING PLUMBER.

THIS Company, one of the most active of the City Guilds, was founded in the sixteenth century, and its objects at that time were probably somewhat similar to what they are at the present day—viz., the protection and preservation of the trade or craft of the plumber. It is well known, no doubt, to our readers that these old City Companies have from time to time been held up to ridicule and scorn, as having ceased to fulfil the ends for which they were designed; and no doubt, in some cases, this has not been without reason. The giving of an occasional dinner, the presentation of its freedom to some titled nobody, and such similar proceedings, certainly do not evince much vitality or energy; and that this is all that some Companies do to advance the interests of the trades they are supposed to represent is too true. The Plumbers' Company, however, is a worthy exception, and has done much within the last ten years to advance the interests of plumbing and sanitary science, especially under the mastership of Mr. George Shaw. Under its auspices a great many reforms have been inaugurated and many benefits conferred not only upon plumbers and the plumbing trade, but on the public at large. Amongst these is the Registration scheme for Plumbers. This was introduced in 1886, and was designed to protect the public from the ignorance and incompetence of workmen who, whilst professing to be plumbers, and taking in hand plumbing work, had only the most shadowy claim to a capacity to undertake any such work. That much illness, disease, and even death, has been occasioned by such incapacity is beyond all question. This Registration scheme was, undoubtedly, a step in the right direction. Briefly stated, it is as follows :—

A register is kept of qualified plumbers, the requirements being that all registered plumbers shall pass an examination in the theory and practice of the trade before a Board of Examiners, consisting of thoroughly practical men. The only exception to this examination is in the case of plumbers engaged in the trade before 1886. These are admitted to the register on furnishing satisfactory proof of their efficiency. Why these persons should have this privilege it is hard to say. It is a weak place in the scheme, and that all who desire registration should show their capability in a practical manner should be imperative. Testimonials are not difficult to get, and this little loophole accounts for a good many R.P's. being not so capable as they might be. Nevertheless, the fact of a man being a R.P. does not thoroughly ensure the public against scamped work—work that may be in accordance with sanitary principles as regards the fixing and general arrangement, yet faulty as regards workmanship and material used — this through the plumber being employed by an unscrupulous builder. What is wanted is that inspectors of sanitary work should be appointed in each town of any size, who should be empowered to inspect all new buildings, and to report to the local sanitary authority if the sanitary arrangements be not properly carried out. They should also be empowered to periodically inspect all dwellings in their district for any nuisances or defects in sanitary arrangements. Most plumbers will bear me out that if such an arrangement were carried out there would be a revival in the plumbing and kindred trades such as has never been heard of. How many pan-closets, for instance, are there yet in London and its suburbs alone? Thousands! These would have to be condemned or altered. It may be argued that it would press hardly on property owners. This consideration, however, can scarcely be allowed to stand in the way of such reforms if in the interests of the public health it is necessary. A man has no right to allow a nuisance on his premises, and to plead that it must remain because he cannot afford to have it removed. For this an Act of Parliament—a species of Public Health Amendment Bill—would be wanted; and members wanting something to do should look to this. This is a matter that the Plumbers' Company might well take up when they have succeeded in passing the Plumbers' Registration Bill. The inspectors under such an Act should not be kid-gloved gentlemen, with a smattering of sanitary science crammed into them, but hard-handed, practical plumbers from the workshop—men who know something about the work they are to inspect. Inspectors such as these would be a terror to jerry-builders and their fraternity; for they would not be able to gull them. With regard to schools and classes for plumbing and sanitary engineering, the Company probably is prepared to render every assistance in its power to towns or localities with a desire to start classes, such assistance taking the form of grants of money or prizes; but something further might be done for the provincial towns. The London technical schools are well provided with teachers, and they have the chance of seeing and hearing the best men and leading lights of the trade. It is different in country towns. Often there is not a first-class plumber in the neighbourhood, and where he exists, he is often not able to teach. If the Plumbers' Company could see their way to retain a staff of teachers, whom they could send, at nominal charges, occasionally to teach classes and inspect work in distant localities, it would be a great boon. Another step that the Company might take would be to communicate with the Technical Education Committees of County Councils and Municipal Authorities, stating their willingness to assist in forming classes for plumbing. Lectures could be given by qualified lecturers, which would serve a double purpose—in educating the public, as well as those in the trade, in the all-important bearing of sanitary surroundings upon the general health. The Company could also do a good work amongst the public by preparing and circulating leaflets bearing upon house sanitation in general, pointing out dangers to health, how to remedy them, and so on. Some controversy has been going on as to the rights of ironmongers to do plumbing work. It is certainly difficult to define what a plumber is. From his name, he is a lead-worker; and

Fig. 6.

Fig. 5.

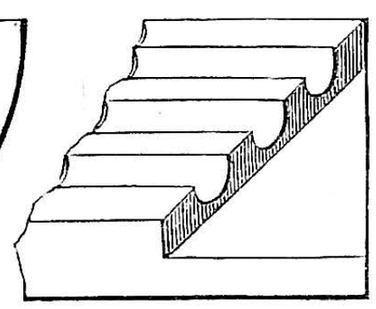

Fig. 4.

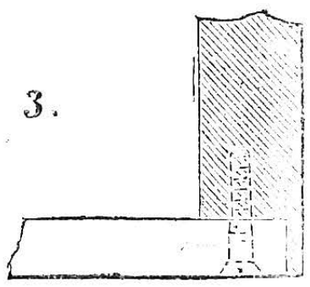

Fig. 3.

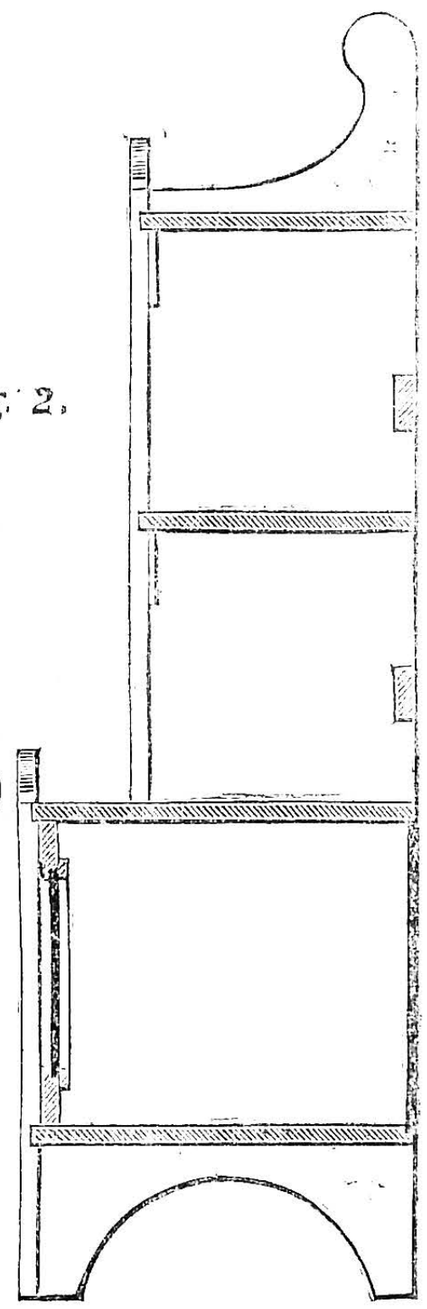

Fig. 2.

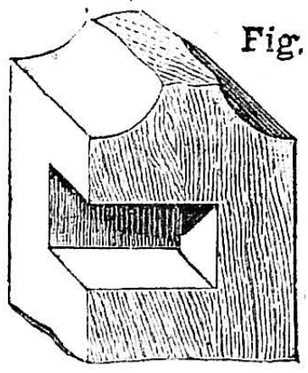

Fig. 7.

Bachelor's Bookcase. Fig. 2.—Section of Bookcase. Fig. 3.—Mode of housing Rails into Sides. Fig. 4.—Butt Mitre-Joint of Door Frames. Fig. 5.—Bracket. Fig. 6.—Panel of Door Frames. Fig. 7.—Showing housing of Shelves. All details to be enlarged to size of Bookcase determined upon.

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smiths and fitters feel that in touching wrought and cast iron-work the plumber is infringing their rights. The inspectorship scheme would soon kill off "duffers," and the public and good men would reap the advantage. The Plumbers' Company, if it wants to justify a continued existence, should be to the fore in matters of plumbing reform.

STAGE DRAPERIES—THEIR PAINTING AND MANIPULATION.

BY W. CORBOULD.

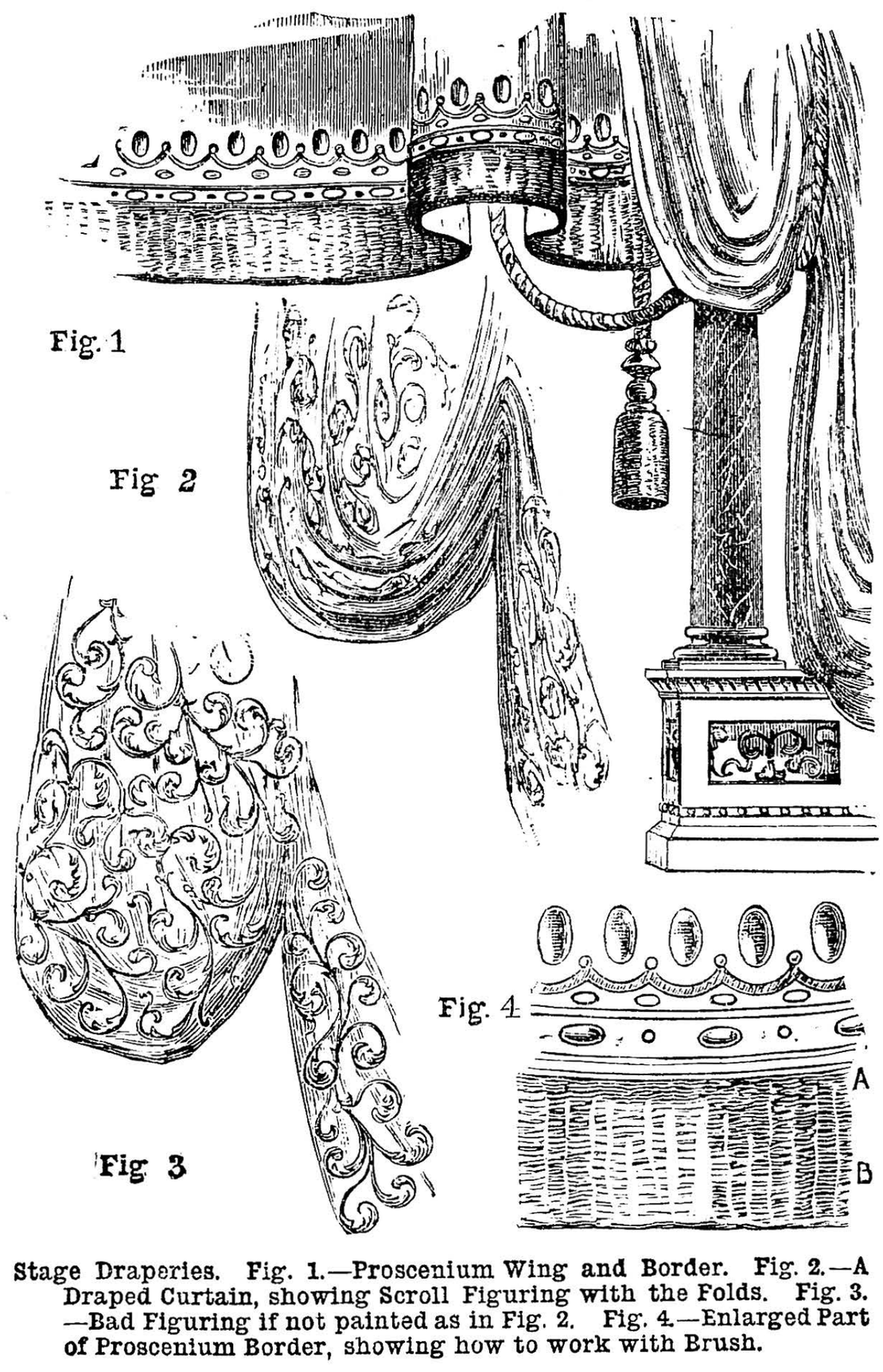
THE amateur scenic artist will find the drawing-in of draperies, no doubt, difficult at first. The best way is to have a cloth or curtain, and hang it in the position he wishes to represent the painting. First mark in all the folds with charcoal, taking care to notice that when a curtain is drawn up, say with a cord and tassel (see Fig. 1), the folds are angular; particularly should the material be of a thick and stiff nature, such as heavy damask, repp, etc. When you are satisfied with the drawing, cover the charcoal lines with Vandyke brown, as taught in landscape (see Vol. II., No. 97); dust off with your flogger.

We now come to the painting. I will describe the way to manipulate three colours—viz., crimson, blue, and amber; any others may be worked in the same way. We will first take crimson. You must thin out some damp lake, and go over the whole of your work; let this dry. Thin out now some brown lake, and lay in all the folds with it. If you have bullion fringe, cords, tassels, or other ornaments which you have already drawn in with Vandyke, glaze these all over with Dutch pink. Fig. 1 shows a curtain of this description. Now glaze over your curtain with thin crimson lake again. You will by this time have got a considerable depth of tone. Now take a clean brush and some shadow colour—thin blue; go over the whole of the shadows—of course, every fold has its own shadow, but where the blue covers the brown lake it will be the deepest in tone—that is, purple; but on the larger wavy folds the blue goes over the crimson, a pale cool shadow of a bluish tint. I may here mention that all shadows on warm colours are cold in tone; the opposite with cold colours, the shadows would be warm. You must notice this when we come to blue painted draperies.

You must now put in your high lights, and for the crimson you are now painting this must be orange red or orange chrome. You must use it with care. Lay it on with a bold stroke; mind the angular form of the folds; soften the edges of these high lights into your crimson. When you have done this, and you think it satisfactory, have some crimson lake or damp lake, stronger in tint than what you have been using, but not much, or it will peel off. Use your large brush, and go over the whole of your work, shadows and high lights as well, but not the part you may have laid in with Dutch pink. I may say here that your size when working your first colours ought to be strong, to prevent them rubbing up in the after glazings; but in the last glazing have more water to it: this will prevent the damp lake from shaling. Now you have got thus far with your work, all you have to do is to consider whether you shall glaze it over again. Should you think that another glaze will enrich the work, go over it again; but before doing so, touch the highest lights with vermilion.

We will now take amber drapery. You make your drawing the same way as in the crimson; the folds and angular forms are the same, of course, in one colour as another. First painting. Take of yellow ochre and raw sienna in equal proportions, and glaze over the whole. When this is dry, lay in with brown lake the shadows and folds; soften the edges off into the yellow previously laid on. Now lay on the high lights with pale orange chrome. After this is all dry, glaze over with the colour you laid on first—viz., yellow ochre and raw sienna. You may now glaze over the shadows with thin damp lake. Now touch in your highest lights with lemon chrome. When this is all dry, glaze over the whole with raw sienna. You will find by this time your work will look finished, but should you think it wants bringing out more, you may glaze over again until you get it to the desired effect.

The next is blue. Of course, the drawing is the same as in the former; it is the manipulation of the colours that I wish to impress upon the pupil. Although I am giving a few colours, there are many other compounded colours, but it is not necessary to go into them here, as the artist will gradually gain the knowledge of compound colours. For instance, purple would be a compound of blue and damp lake; pale rose colours would be white with your crimson and damp lakes, according to the depth of tint; white lace curtains, worked out in patterns, try the skill of the artist—their shadows are delicate blue. Where heavy folds, a very little Vandyke brown would have to be added to the blue, or glazed over it. Then there are the different shades of green, from very deep to the palest sea or pea green; in fact, drapery painting is a study in itself, but "practice makes perfect."



Stage Draperies. Fig. 1.—Proscenium Wing and Border. Fig. 2.—A Draped Curtain, showing Scroll Figuring with the Folds. Fig. 3.—Bad Figuring if not painted as in Fig. 2. Fig. 4.—Enlarged Part of Proscenium Border, showing how to work with Brush.

After this digression, we will now go on with the blue. Assuming you have done your drawing in as before, and all is quite dry, you first glaze over with thin azure blue. Lay in the folds and shadows with thin damp lake. This will keep the shadows warm; blue being a cold colour, it would not do to put a darker blue for shadows, although some artists do it; but it is not right. I have known others to use ultramarine, which is a bad colour; in artificial light it goes black. Prussian blue may be used, but my experience has taught me that for stage drapery nothing beats azure blue when painting blue drapery.

We will now suppose you have finished the folds and shadows with damp lake; should you require the folds or shadows in any part very strong, use a little brown lake with your damp lake, using your own judgment for depth of tone. After this is all dry, glaze over all with your azure blue. When this is dry, should you wish to have it deeper in tone, touch up your high lights with white, and glaze over again with your azure till satisfactory. Green draperies are worked the same—that is, royal green, emerald, and the green lakes would come into their composition.

We now come to bullion fringe and other ornaments, such as cords, tassels, etc.

There may be figures, such as scroll-work, flowers, etc. You work these out with small fitches after you have finished the painting, taking care that the pattern falls in with the folds. (See Fig. 2.) It would not do to cross the folds with the pattern or figures. (See Fig. 3.)

To paint bullion fringe, you require in colours, brown, brown lake, lake, orange chrome, lemon chrome, celestial blue, and Vandyke brown. You have drawn in with Vandyke brown, and glazed over with Dutch pink (Fig. 2). Now take brown lake, and with your small fitch cover your former work that you glazed over with Dutch pink. Fig. 4 shows the work of Fig. 1 enlarged. With orange chrome you must touch or paint in here and there, not go all over your work; then with lemon chrome you go over other parts. When this is all dry, glaze with thin blue the top parts of your fringe (see A, Fig. 4), and all heavy parts should have their shadows bluish in tint, but glaze here and there with some thin lake. This is for the reflections of the crimson curtain caught up by the gold. All these colours placed

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one against the other will produce brilliancy—that is, the highest lights will be pale lemon chrome, then deeper lemon to orange, and so to brown lake. A little practice will soon overcome any difficulties. It is almost impossible to give the idea fully without the aid of colour. Fig. 4 shows the sort of wavy line which you keep making with each colour, using small fitch brushes for the purpose.

DIVIDING AND REVOLVING FLOWER-POT AND TUB FOR HEAVY PLANTS AND TREES.

BY J. CHARLES KING.

To the horticulturist who has to handle large shrubs and trees in tubs this invention is of real practical value for its economy of labour in potting and shifting heavy plants, etc., without much trouble, as occurs with ordinary pots and tubs, and with no risk to the plant or pot or tub in the process.

For palms, orange-trees, cacti, and other tropical plants and trees, it is now necessary, when they have grown too large for the pot, to lift them out, or break the pots, or dig out of the tubs. As they sometimes weigh from half a ton to a ton or more, this means the use of a lot of muscular strength, but, withal, often unsatisfactory, by its delay and cost; and for turning a tree in a conservatory, to present foliage in a better aspect, or to receive the sun on an opposite side, crowbars are brought into use, often to the damage of the floor of the conservatory, and always injury to the bottom of the staves of a tub or box, and sometimes to the injury to the bloom of the plant or contiguous ones, where crowded together. And where the tree has to be shifted from a glass-house some distance into the open ground, it is a costly job in labour and appliances for the tub to slide on, as anyone who has seen the shiftings at Kew or similar large gardens knows well.

Mr. A. Taleyrac, of large experience in France, Algiers, and England, in connection with tree and plant growth in tubs, etc., has made the whole subject of pots and tubs a special study, and, being essentially practical, he has invented (1) a revolving flower-pot or tub, formed in two halves, (2) a double bottom for revolving, and (3) a cradle-frame for its transit for short or long distances. He has taken it out of the realms of theory into the workshop of practice. By detailing it, we at the same time are better able to describe the inventions, two of which are at the head of these notes; the third needs no illustration.

Assuming the tree to weigh, with its earth and tub, about two tons—and this has to be put into a bigger tub or box—his first course is to prepare a tub with a revolving bottom. The bottom he has made of galvanised iron, sufficiently thick to have a circular channel sunk in it (as shown by Fig. 1). This channel is for balls ½ in. diameter. This fits exactly over a similar stationary bottom of iron, so that one bottom revolves, by means of the ball bearings on the other, so easily that a boy can turn a heavy tree and its earth and tub completely round. Now, to lift a ton-weight tree that almost touches the top of the conservatory is not to be done easily; but to unhoop the common tub and take away the staves is easy enough, leaving the tree standing on its own old tub-bottom. A tripod of iron, with a jointed ring, padded, to grip the tree below its lowest lateral branches, and the three iron legs of this tripod being screwed into loose nuts let into base-blocks resting on the ground, enables the swivelled legs to be turned simultaneously in the nuts, to raise the tree 2 in. or more, so as to shift away the old tub-bottom, and insert the larger revolving tub-bottom under the bulk of earth. To obtain its environment of a larger tub is the easiest part of the work; for it is in two halves, and has two or more hoops on, that overlap each other at opposite sides of the tub. These overlapping hoops are secured by pins, that hold the hoops immovable. This is only the work of a minute for two men. The space between the bulk of old earth and inside of the larger tub has only to be filled in with extra mould, and the job is finished.

To effect easy transit of heavy trees and plants to or from the house to the open, Mr. Taleyrac secures the lower bottom of tub to

Fig. 2

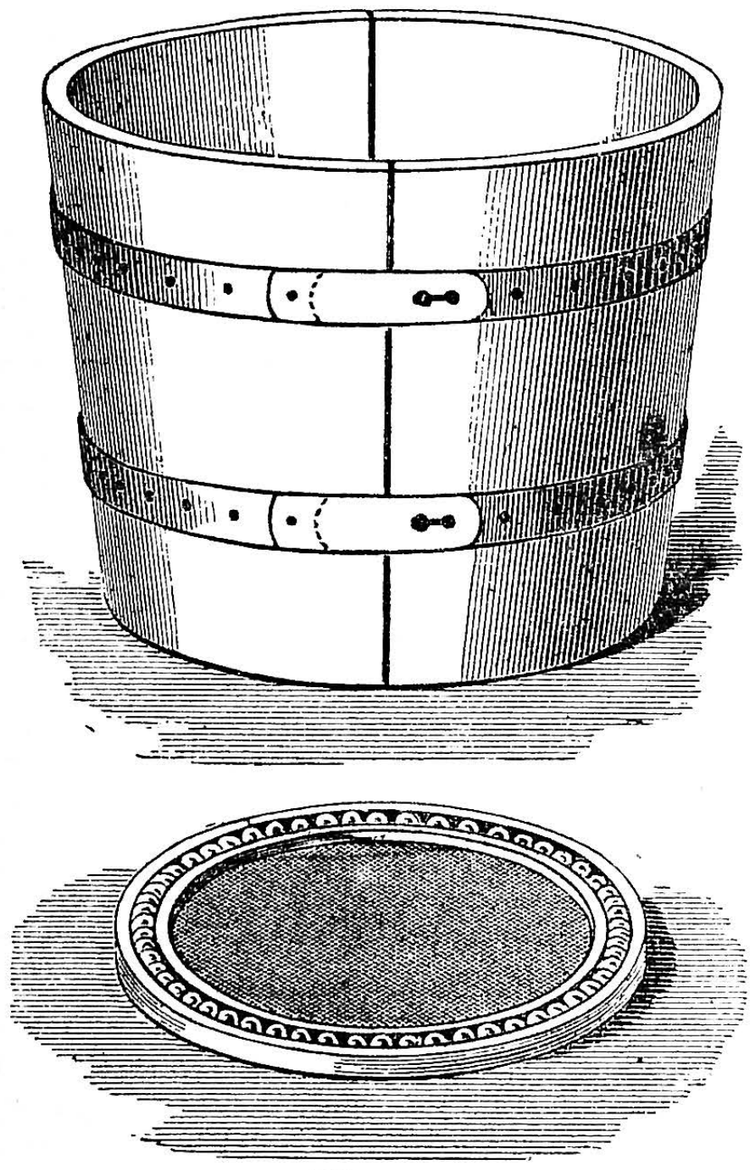

Fig. 1

Flower-Tub. Fig. 1.—Bottom. Fig. 2.—Dividing-Tub.

a frame, oblong in form. Under this frame, at each corner, is an improved caster-roller, which allows the whole to be pulled by a rope by two men, without the need of nine or ten men, with two or three crowbars, as with the old tub. A light lifting-jack, of simple make, raises the ends of the frame when wanted to be lifted on or off guide-planks, up or down stairways or steps or slopes, or over soft turf.

This oblong frame has holes for suitable staple-sockets for a pair of shafts to be attached, and an axle for a pair of wheels, fitted so as to use it as a "gig-frame" for horse draught, if needed for distant transit. For the more scientific handling of plants of large growth these inventions give facilities not attainable with the tub or box with fixed staves, as for opening the tub for root-grafting, fossicking for a worm amongst the roots, adding special manures, or introducing electrodes, etc., so easily done by lifting away one side of a tub or pot.

In the technical contrivance of half-tubs or pots there is no difficulty, as earthenware serves as well as wood, or compressed fibre, or anything suitable.

For the wooden tubs the staves are not bent, but left flat, so that the tub is polygonal, and either dowelled or tongued and grooved. Two inches up from the bottom is an inner curb or ledge on pots and tubs. This takes the pressure off the bottom, which the fastening of the hoops tightly holds securely to the inner periphery of the tub. A stave can be taken out and replaced by another if repairs are needed. In fact, the sides may be taken away, leaving the tree standing with supports in a glass-house, for painting and quick-drying in the open, and be replaced easily. The necessity for trees being quickly moved from open ground to shelter is an item of importance which can be appreciated by those owning valuable trees and plants. As every part of pots or tubs is to be made to uniform sizes the renewal of parts is simple.

The square boxes and tubs are found to be not the best shape for root-growth, the angles holding earth which is of no use to the vitality of the roots, and their shape cannot be regarded as ideal.

VOLATILE COMPOUND IN IRON.

ELECTRIC energy in any form is but change effected with intensity of motion; everything known is susceptible to electric energy, though some materials are better within the operation of our knowledge than others. Perhaps the simplest demonstration of energy not directly electrical, though incidentally so, is the heating of steel to a molten state. It assumes a white light, similar in many respects to the electric light. Perhaps by the polariscope its electric character may be demonstrated some day.

The magnetic receptiveness of iron has never been explained; investigations are being carried on by chemists into the volatile compound in iron. One method of procedure by Messrs. Langer and Quinke consisted of reducing ferrous oxalate in a stream of hydrogen at a temperature of 400° C., and passing carbon monoxide over the product heated to 80° C. The new body is volatile, and is decomposed on heating, depositing a mirror of metallic iron. The deposited metal gives the reactions of iron definitely, establishing its identity; only a minute quantity is obtainable from a large bulk of iron, so that at present satisfactory analysis is difficult. Whether this volatile product is in any way a link of magnetism to iron is a problem to be investigated by science.

PRESERVING WOOD.

A NEW method of impregnating logs with zinc chloride, to preserve them, is known as the Pfister process. The timber is impregnated in the forest as soon as possible after it is felled. The zine chloride solution has a specific gravity of 1·01, and is forced into the thick end of the log by a force-pump. To this end, an iron disc of suitable diameter, and furnished with a cutting rim, is forced into the end of the log and secured by clamps. The time required for this preliminary work is only three or four minutes for each log. After a pressure of two or three atmospheres has been maintained at the thick end of the log for a few minutes, the sap begins to exude at the opposite end, and finally, a weak solution of zinc chloride comes through, showing that the operation has been completed. About 2¼ gallons of the solution are required per cubic foot of timber treated.

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PIANOFORTE TRADE APPRENTICES.—The scarcity of skilled labour in the musical instrument trade is forcing itself upon the responsible members of the trade. It is now sought to revive the question relating to apprentices. The idea is that it is not advisable to revert to the former method of teaching the whole of the branches, with the result of giving the youth only a smattering of his business, but rather that it would be best to thoroughly ground the apprentices in one branch, in which they may excel. [This apprentice question is one affecting every trade of the country, and cannot be too forcibly or honestly put before the tribunal of public opinion and trade council in every department of labour. If commerce is to go on in this great country, if Britain is to maintain its commercial supremacy, the out-going race of workers must be replaced by an equivalent. It behoves every firm, every manager, every head of a department to see that, while the old blood is dying out, a new element is being incorporated and trained in the traditional lines of past custom and usage. It is not only the pianoforte trade which is concerned with the question of apprentices. There is not an industry in the country that is not involved. Such a matter as this concerns every worker who has any true soul for, or interest in, the trade upon which he has been called to stamp his personality. We wish more enthusiasm could be roused among managers and workers upon questions such as these, which are truly worthy of being digested in preference to many of the useless topics upon which men fritter away their intelligence. Every British trade ought to have something to say about its apprentices.—ED.]

ARBITRATION V. STRIKES.—Labour troubles in the United States have again attracted necessary attention to the relations between labour and capital. Let us glance at the situation at home. Yesterday, as it were, London was the scene of a gigantic dockers' strike; then came the lesser movements of gas stokers and omnibus employés, and still more recently a disruption of the London building trades, owing to the carpenters' dispute. Turning for a moment to the provinces, we find Birmingham, Bolton, and Cardiff heading a list which, if alphabetically completed, would astonish us with its record of wasted time, energy, and treasure. What of the future? True it is that here strikes have not yet been carried to sanguinary extremes, but who can say how long this will continue? Thus we cannot watch with apathy the widening rift between labour and capital? What master and worker have to do is to look with a kindlier eye one upon the other. Surely such matters as a five per cent. advance or a half-hour's less labour per diem do not warrant such extremities as those resorted to in the Carnegie riots. Combination we fully believe in and uphold, but only combination of the right sort. Justice and equity are the foundation of all effort in this capital and labour solution, and their attainment should be distinguished by manliness, common sense, and personal respect. The real mission of trade combinations, on the part of capital, is to minimise the dangerous and laborious aspect of each industry, to encourage perseverance and original research, and, particularly, to advance the education of craftsmen and the training of apprentices. Now a word with our brother craftsmen. We labour from necessity; but this labour may none the less be a labour of love, and the greater the interest therein the better will be our results, and, consequently, of a higher monetary value. Labour and capital have no interests that are not mutual, and a commercial nation like ours should waste neither time nor money on inter-commercial warfare. Energy in this shape would be better employed in advancing technical education in every branch. The present discontent is but the shadow of the coming greater social problem—that of profit sharing. Sooner or later capital must grasp this fact; and the sooner the better! Meanwhile, let arbitration be the aim and hope of both employer and employed.

WORKING CLASSES TAXES.—There is no country in which fewer articles of consumption are taxed than this; yet, even so, people are beginning to complain of the unfairness of such taxes. Take tea, for instance, of which a washerwoman probably consumes more than a millionaire. The tax on this article is 4d. per lb. Now, the poorer people pay sometimes only 1s. a pound for their tea—8d. being the worth of the tea, and 4d. the amount of the tax. Rich people pay 4s. a pound, of which only 4d. is for the tax. Thus one-third of the whole price—or, if there were no tea tax, as much as would purchase half a pound of tea—is paid by the poor on every pound of 1s. tea they consume to Government; whereas the rich pay only one-twelfth on their pound of tea, or, if there were no tea tax, as much as would purchase less than $1\frac{1}{2}$ oz. of 4s. tea. The above may be brought more forcibly home by stating it this way:—Out of every twelve cups of tea that come from the poor man's tea-pot four are drunk for the Revenue, while out of the same number from the rich man's only one is so drunk. The same unfairness is exemplified from the tax on tobacco. The workman pays 3d. an ounce for his tobacco; of this 3d. as much as $2\frac{5}{8}$d., that is $2\frac{1}{3}$d. and half a farthing, is for duty. The millionaire pays 1s. for a cigar; of this 1s. only $\frac{3}{5}$d. is for duty, the remaining $11\frac{2}{5}$d. is for the article he smokes. Thus out of every 1s. the millionaire spends on cigars he contributes just over $\frac{1}{2}$d. to the Revenue, while out of every 1s. the poor man spends on tobacco he contributes $10\frac{1}{2}$d. to the Revenue. These inequalities ought to make men think.

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"CLEADING" OR "LAGGING" VERTICAL BOILERS.

BY J. H.

PURPOSE OF CLEADING—PREPARATIONS—RINGS, ETC.—METHOD OF SECURING THE RINGS—SEATINGS FOR THE MOUNTINGS—THE LAGGING STRIPS—BONDING THE LAGGING—IRON CLEADING—COVERING FOR TOP OF BOILER.

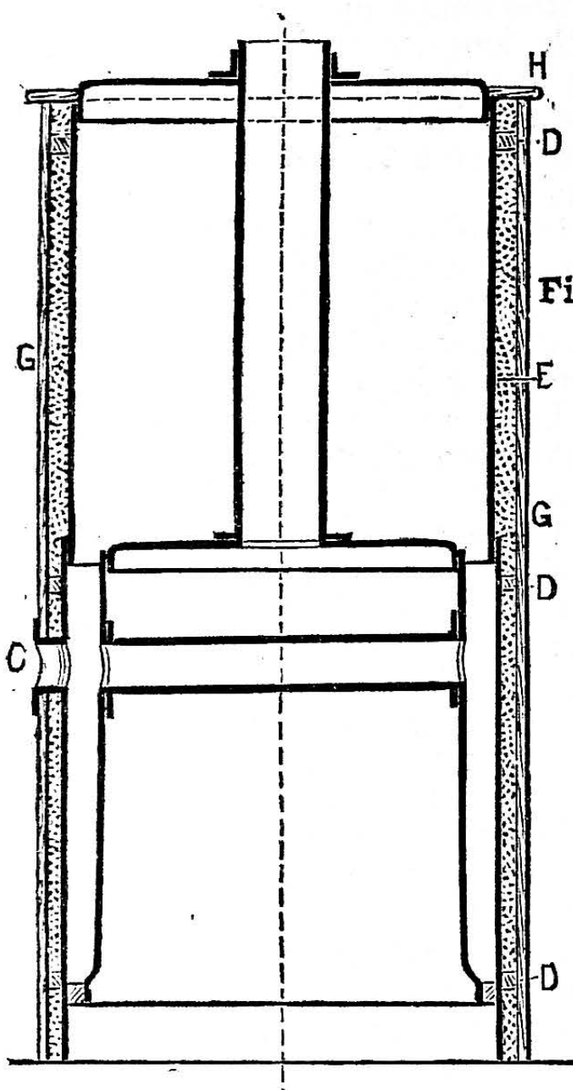
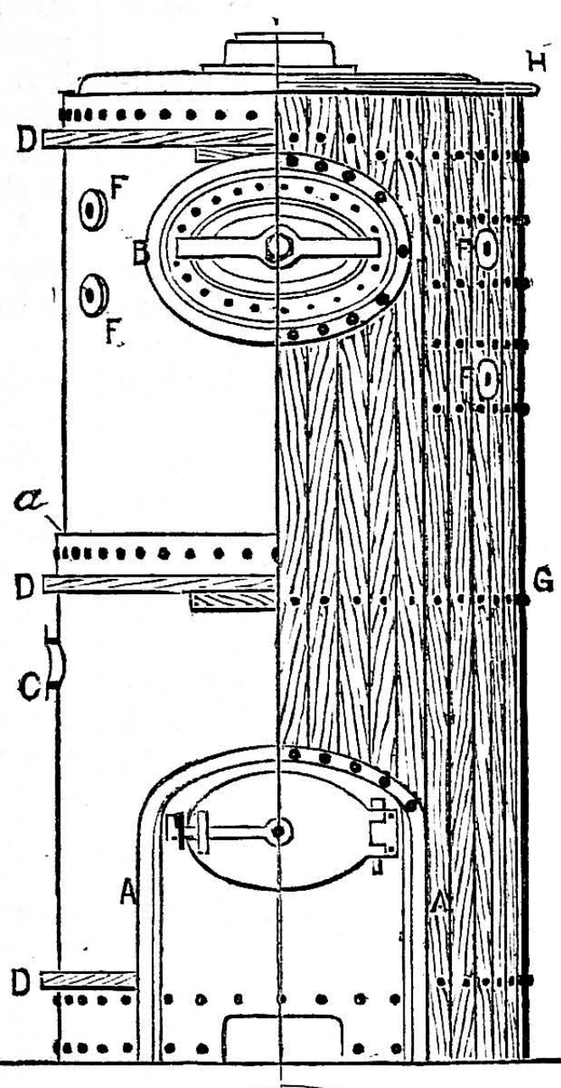


Fig. 1.



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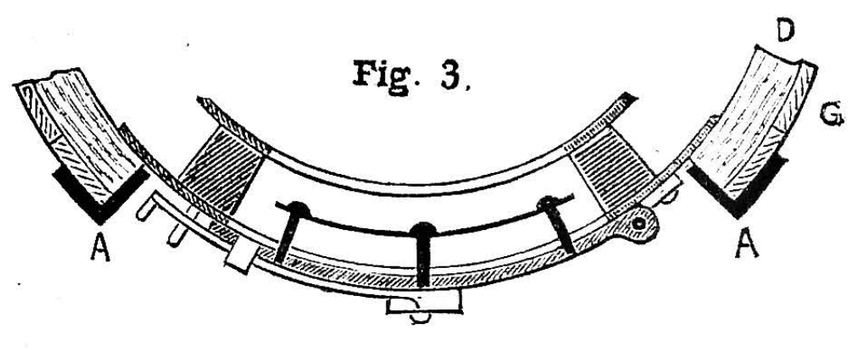

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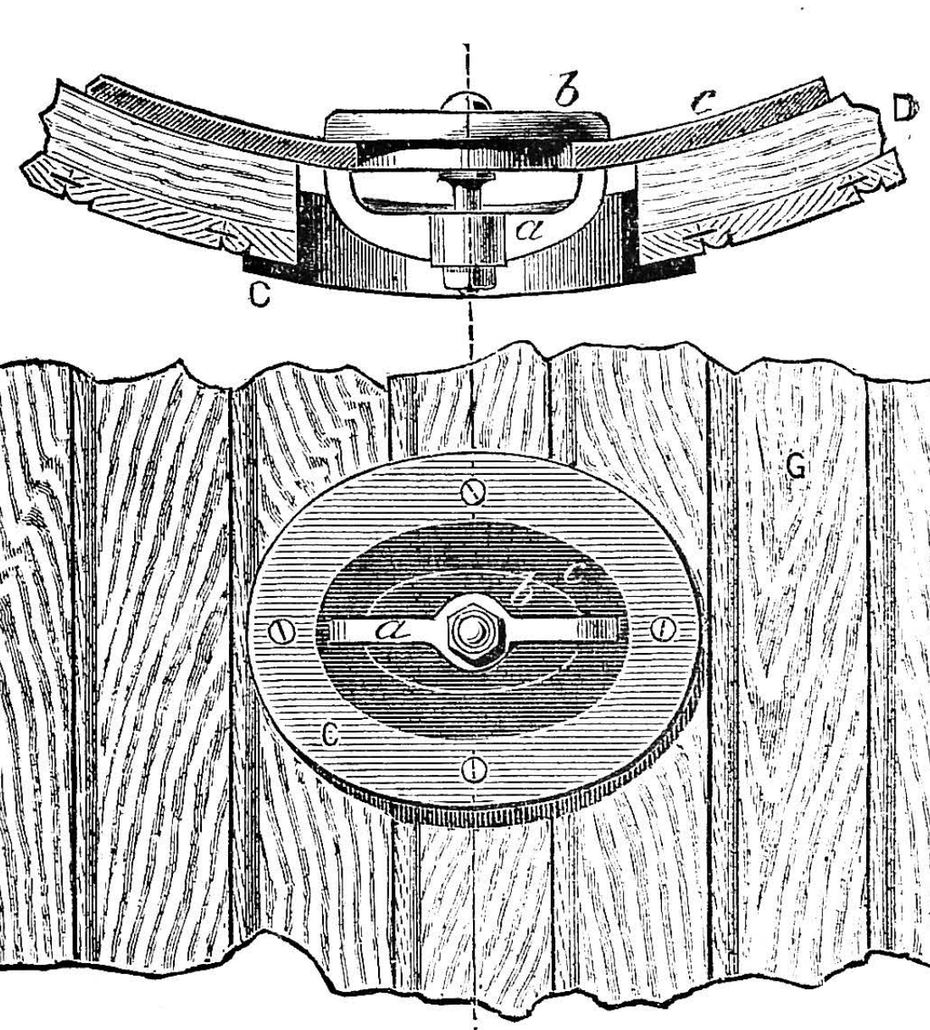


Fig. 4.

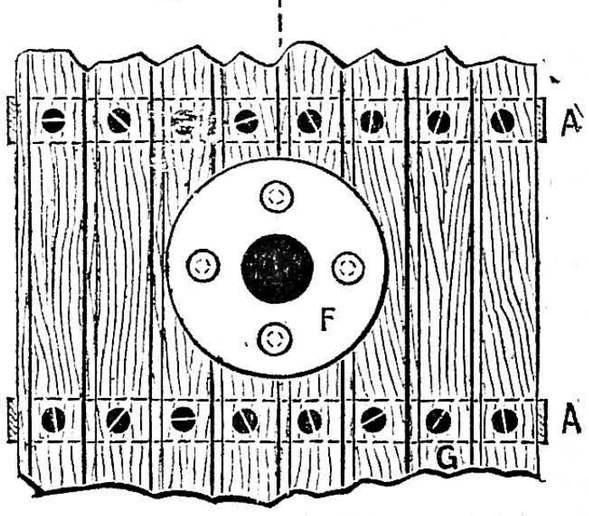
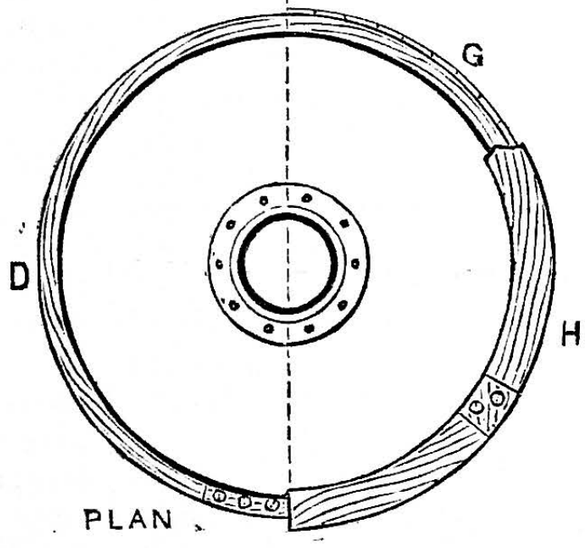


Fig. 7



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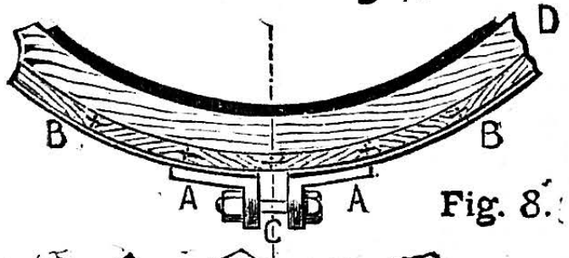
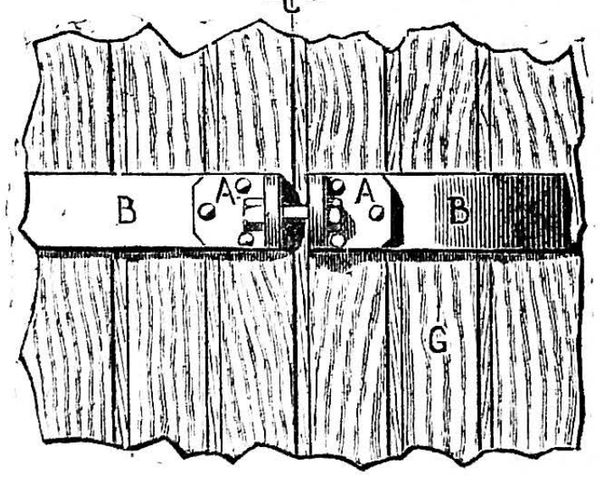


Fig. 8.



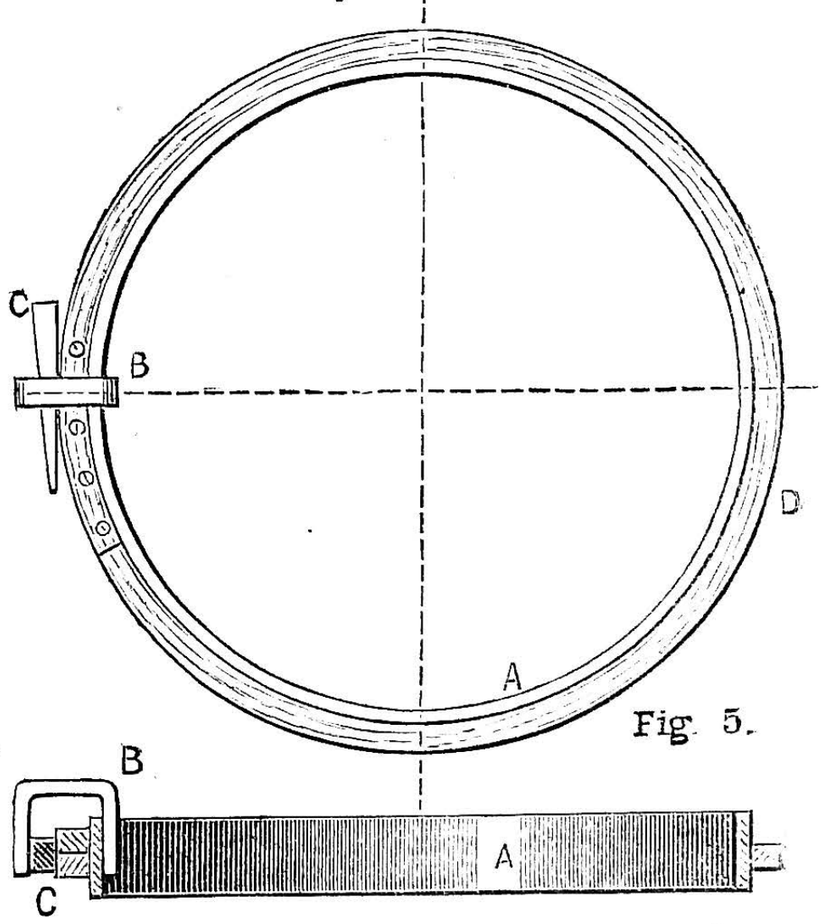


Fig. 5.

Purpose of Cleading.—Vertical boilers are cleaded, both to prevent radiation of heat and for the sake of good appearance. The usual practice is to clothe the boiler with a layer of felt, and to enclose and confine this with lagging strips of wood or with sheet iron. Fig. 1 is a section through a boiler and its cleading. Fig. 2 is an outside view, showing the cleading on the right-hand side and the naked boiler on the left-hand side, embraced only with the hoops upon which the lagging strips are screwed. Some enlarged details are shown in the figures.

Preparations for Lagging—Rings of Angle Iron.—When boilers have to be cleaded, the first steps necessary are to have all the fittings in place, and to make and fit the rings upon which the lagging is screwed. I will consider these points, therefore, now in turn. And first, as to the fittings: Before a boiler can be cleaded, provision must be made for leaving neatly finished openings around the fire-door and the ash-hole, the man-hole, and the mud-doors, and also for bringing such of the mountings as are fastened to the sides of the boiler out to the face of the lagging. For the first-named purpose, rings of suitable form, made of angle iron, are made and fitted; for the second, seatings of cast iron are screwed to the boiler-shell. Around the fire-door the angle iron, A, is bent (Figs. 2 and 3) in the form of an arch; around the man-hole it is made of elliptical form, B (Fig. 2). Rings of the same shape, but smaller, enclose the holes opposite the cross-tube or tubes (Figs. 1, 2, and 4), C, and the mud-doors at the bottom of the boiler, not seen in these views. These latter, being so small, are made of cast iron to angle iron section; the others are made of angle iron bent, and in the case of B, welded up. The large rings, as will be seen from the section at Fig. 3, stand radially in relation to the boiler, and their depth is such that the under face of the flat flange rests upon and covers the face of the lagging. The rings need not necessarily be deep enough to touch the boiler-shell; it is better if they are left to clear it by, say, $\frac{1}{8}$ in. or $\frac{1}{4}$ in. The small rings for the mud-holes (Fig. 4) are parallel internally, and are sufficiently large to clear the bridge-piece, *a*, by means of which the mud-door, *b*, is pulled up against the boiler-shell, *c*.

Rings of Ash.—The rings, D, in the various figures, upon which the lagging is screwed, are made of ash. They have a cross section of from $1\frac{3}{4}$ in. square to $1\frac{3}{4}$ in. square, dependent upon the size of the boiler. Three

Vertical Boilers. Fig. 1.—Sectional Elevation of Vertical Boiler, cleaded or lagged. Fig. 2.—Half Elevations of Vertical Boiler, with Outside Lagging, and Lagging Strips removed. Fig. 3.—Horizontal Section through Fire-hole Door and Angle-Iron Ring. Fig. 4.—Section through Mud-holes. Fig. 5.—Method of bending the Rings of Ash. Fig. 6.—Saw-Kerf Method. Fig. 7.—Fastening of Lagging around Seatings. Fig. 8.—Fastening of Bonds.

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such rings are required for small boilers, four or five for those of large size. The rings are bent to the curve of the boiler, either by steaming or by saw-kerfing them. In the first method the strips are planed to section, and sawn long enough to encircle the boiler, and to overlap to the distance of 1 ft. or 15 in. They are then placed in a long wooden box, into which steam is turned. After, perhaps, an hour's steaming they are taken out and bent around an iron ring (Fig. 5) of the same diameter as the outside of the boiler on which they have to be used. A strip being clamped at one end, the free end is pulled round and clamped at intervals, until the ends overlap, when they are wedged together with a cramp, B, and wedge, C, and screws are put in to secure them fast. When dry, the rings retain their curvature. In boilers of small diameter, however, there is so much tension put upon the fibres by this method that the rings sometimes break.

The whole process is rather roundabout, and not so well as the second method of saw-kerfing. In this, the strips, after being sawn and planed, are saw-kerfed (as shown in Fig. 6) at intervals of about every 1½ in. or 2 in. Then, without having to resort to steaming, the strips can be easily bent to the curvature required, of course around the templet ring, and the overlapping ends will be screwed together. Before any lagging is screwed on these wooden rings, the angle iron enclosing rings and the felt have to be put around the boiler.

Method of securing the Rings.—The wooden rings are merely pulled tightly over the boiler. The overlapping ends are first unscrewed, the rings put in place, and the ends overlapped, and again screwed together. The friction of the rings will hold them in position until the lagging is screwed on. Note that the thicknesses of the rings are not alike. In consequence of the lapping of the plates, the upper ring is thicker than the lower ones by the thickness, A (Fig. 2). The large iron rings are partly held with screw-bolts—say, two—in the ring that encircles the man-hole, and three in the arch that encloses the fire-door. The small mud-door rings are not screwed on at all, but they are held for the present by means of the bridge-piece which is used for tightening up the mud-door, the bridge-piece being turned a quarter round and reversed, so that the convex portion of its arch just bears against the upper and lower edges of the enclosing ring. Presently, when the lagging has been fitted, screws are put through all these rings into those portions of the lagging that come underneath the rings, and these screws afford mutual support to the lagging and to the rings. The felt (Fig. 1), E, bought in sheets, is wrapped around the boiler, and is held while the lagging is being fitted with fine iron or copper wire wound round it.

Seatings for the Mountings.—Blocks, F (Figs. 2 and 7), that serve the purpose of seatings for the various brass mountings, are also studded and riveted to the boiler in their proper positions. There will be blocks for the water-gauge, check-valve, blow-off cock, and injector, if such is used. In small boilers, however, seatings are commonly used only for flanged fittings, such as the blow-off cock, and other fittings are tapped into the shell direct instead of into seatings. If this method will not allow the fittings to stand out far enough to clear the cleading, then, instead of seatings of cast iron, short pieces of steam-pipe of suitable length are screwed into the shell, and the mountings are screwed into these.

The cleading having to be cut off in shorter lengths to fit against the cast-iron seatings, and no means of screwing it existing as in the frames of angle section that fit around the large openings, it requires to be supported and held fast independently of the seating. This is done by laying short sweeped pieces around the boiler, above and below the seatings (Fig. 7, A), and screwing the cleading upon these. The sweeps, being extended to right and left, underneath the continuous strips, cannot yield, and so it affords support to the severed lengths.

The Lagging Strips.—All is now in readiness for the lagging, G, in the figures. This is made of deal or of mahogany, in strips measuring about 2½ in. by ½ in. It is grooved at the edges with saw-kerfs, to take hoop-iron tongueing. It is also beaded on one edge to break joint, for the sake of good appearance. The lagging is bought in this condition, and all that the carpenter has to do is to cut it to lengths, lay it round, and screw it to the rings.

Where there are no encircling iron rings in the way, the lagging strips pass right from top to bottom of the boiler; but at all other places their ends are cut to fit against the iron enclosing rings. As they are fitted, they are screwed to the wooden rings, one screw being put through each strip into each ring. Also a screw is put through each iron ring into each separate piece of lagging.

Bonding the Lagging.—However well strips may be fitted and laid round, the weather and the heat of the boiler will soon warp them out of truth, and they will bulge and become uneven between the rings. Hence one reason why bonds of metal are commonly employed to confine them in place. They are not essential with wood cleading, as they are with iron, and are not always put on. Still, they are used with advantage, and if made of brass, improve the appearance of the cleading. They are not shown in Fig. 2, but the ends of a bond are shown in Fig. 8. Bits of angle iron or light forgings, A, are riveted to the ends of the bonds, B, and a bolt, C, pulls these up nearly together, so tightening the bonds round the wood.

Iron Cleading.—With iron cleading the bonds are essential. There is not much to be said about iron cleading. The boiler is felted first, as when wood is employed, and wire is bound round the felt to keep it in position until enclosed with the iron. Wooden rings are frequently used, and the iron lays upon them and upon the felt, requiring no screws, and no fastening save the bonds. Generally, however, the sheet iron does not lay in direct contact with the rings and felt, but a rough wooden cleading is interposed, consisting of rough sawn strips without tongueing, nailed upon the rings. Around this cleading the encircling sheet iron is laid. The sheet iron has to be cut out to clear the various openings, and bent to the necessary curves in bending rolls. Some prefer sheet iron to wood, and it has the advantage of being unaffected by weather, and always presents a smooth and clean appearance.

Covering for Top of Boiler.—The top edge of a cleaded boiler is covered over with a piece of iron, or more neatly with a ring made of short segments (H in Fig. 2). Occasionally cast-iron covers, cast with openings for the safety-valve and chimney, are made use of.

Should any of the numerous readers of WORK, having to do with boilers, be in any difficulty, please put a question through "Shop" columns.

THE STOPS OF THE PHOTOGRAPHIC LENS.

BY AN OLD HAND.

VERY many amateur—I think I may include some professional—photographers are somewhat in a fog with respect to the use and effect of the diaphragm of the photographic lens. They know that a small stop sharpens the image and reduces the light, making the lens act more slowly, and that if a large aperture is used the exposure is much shorter, the image being less distinct; this being the sum total of their knowledge of the subject.

A photographer thoroughly conversant with the use and effect of stops has a power in his hands too valuable to be neglected, and he will succeed in making good work with a lens that in the hands of his less-informed brother would be almost useless.

Now, let us see what the stop will do, and why it does it. Suppose we examine the image on the focussing screen with the full aperture of a single lens: we find that there is a great falling off in definition towards the edges; also the different distances vary in sharpness. If we rack the camera to get the distance or middle distance perfectly sharp, the foreground is woefully blurred and indistinct, and *vice versâ*. It may be remarked lenses vary very much in defining qualities, some being much better than others *when used without a stop*, but with one, may produce equally good work. The so-called single lens is in reality two lenses of different kinds of glass accurately cemented together to form what is termed an achromatic meniscus. The advantage of making a lens of two pieces of glass of different density is that by so doing it loses its power of adding a fringe of colour to all objects depicted on the screen by it, or, in technical terms, it is achromatised; not only this, the power of giving equal definition over the whole of the picture or field is increased. It is a singular thing that certain kinds of single lenses, uncemented ones, or uncorrected, as they are usually termed, will give pictures practically free from the colour fringes, but to do this they must consist of *very thin* glass, the non-achromaticity depending almost as much on the *thickness* of the glass as on its density. Also very small stops must be used, or the depth of definition will be so small as to render such lenses practically useless for photographic work. The size of the stop, besides regulating the quantity of light to be admitted to the plate, also determines how many of the rays of light falling obliquely on the lens shall be allowed to pass. It may here be said that rays of light passing through the centre of the lens are parallel, and the further from the centre they are the more oblique they become. The use of the small stop is to restrict the formation of the image to these more central rays, which, when no stop is used, become confused and mixed with the oblique rays, which, coming to a focus at different distances from the lens, will produce a blurred picture. The quality of a lens is estimated by its power to produce a sharp image, with a large stop, over a large area: the better it will do this the greater the estimation in which it is held. Very indifferent lenses will produce fairly sharp pictures if very much stopped down. Here, again, we must notice if the glass of which the lens is constructed is free from defects, such as scratches, striæ, etc., for if such faults exist in the *centre* of the lens and we use a very small stop, which utilises just that part of,

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the glass that is defective, the small stop in this case, instead of improving the definition, will make it worse, owing to the defective part being *alone* used to form the image. The *central* portion of a lens should always be free from *any defect whatever*. Small striæ or scratches in other parts are not of such vital importance, although the lens is best without them, but if they occur centrally the advantage of the stop is considerably impaired. The position of the stop has great influence on the resulting image. With single lenses (that is, the achromatised meniscus) the stop is placed considerably in advance of the lens, for two reasons—the definition is better and the rectilinearity is improved, but we get a smaller area of illumination. If the stop is too much in front the corners of the picture are cut off, and if too near, the curvature of straight lines is more evident. It must be understood all single lenses give curved lines, more or less, in all parts except the centre of the picture; the distance of the stop from the lens is calculated so as to reduce the curvature to the least possible quantity by cutting off oblique rays without reducing the area of the image in too great a degree. In some lenses I have seen the position of the stop has been such that the plate would be properly covered with the larger sizes, but with the smaller ones the corners of the picture were shaded off, proving the distance of the stop from the lens was too great. If we place the stops behind the lens, instead of in front, we do *not* get rid of any of the curvature, the area of illumination is not interfered with, although the image is sharpened up in about the same proportion as though the stop was placed in front; the advantages are, however, decidedly in favour of stops in front. With portrait combination of lenses, the best place for the stop is about midway between the combinations at that point where the rays cross in passing from one lens to the other. On account of the great roundness of the field only a very small part of the image will be quite sharply defined, but that area will have better definition than with any other kind of lens—in fact, so far as it goes, we will term it optically perfect; but the perfection of this small area is at the expense of the larger. With all lenses not intended specially for portraiture a compromise is made by getting something less than perfect definition over a large area instead of excessive sharpness over a small one. The rapid rectilinear is an example of this compromise, and other lenses of like form are constructed to the same ends. With the improvements continually taking place in the manufacture of glass, we may hope eventually to have perfect flatness of field and depth of definition, with large apertures. The Ross concentric lens is a step in this direction.

In the use of single lenses for architectural work, for which special purpose they are unsuited on account of the curvature of the straight lines, especially as we approach the edges of the circle of illumination, the best plan is to only use the centre of the plate, where the curvature is scarcely perceptible for the more important architecture, and then, if there is a considerable amount of foliage, or other subject not consisting of straight lines, at each end of the picture, the distortion will be scarcely noticed. Use a small stop in *front* of a single lens; this remark may be deemed unnecessary, as the stops are usually fitted to the lens in their proper places, but if a lens is extemporised by the use of one combination of a doublet the advantage of removing the *front* lens will be perceived. According to theory, all lenses are equally rapid if used with a stop bearing the same proportions to their focal length as each other—that is, a lens of 12 in. focus would, with a stop of $\frac{1}{2}$ in. diameter, have the same rapidity as a lens of 6 in. with a stop of $\frac{1}{4}$ in. diameter. However theoretically correct this may be, it is not always borne out in practice; the colour of the glass and its thickness have considerable influence in determining the result. It must also be borne in mind that the activity of light on a sensitive surface is increased or diminished according to the square of its distance from it, but the small differences that exist with ordinary lenses make this factor practically inappreciable, unless in dealing with large-sized enlargements; the distance of the paper from the lens has then to be taken into account.

A good single landscape lens may be advantageously used for portraiture if large heads are wanted, working with a large stop, as in this work the surroundings are really better if not in focus. The leading lines in the face being well made out are all that is required. The number of stops supplied with the generality of lenses are really unnecessary, three being ample for all purposes. Take it all round, a stop representing F 32 will be sufficiently small for any ordinary work, one of F 64 for special subjects, and one of F 16 for rapid exposure. When the full aperture of the lens will not give sufficient definition, by making it a rule to work with one special stop—say, F 32—a uniformity and certainty is introduced into the exposures; that results in even and good work that is absent when the practice of shifting about from one stop to another is adopted. My advice is, alter your exposures, but do not alter your stop. Any lens that will not cover well the sized plate it is advertised to with F 32 is a bad lens, and should be got rid of. To find the focus of the lens, measure from the back surface of the lens to the ground glass when the image of some distant object has been sharply focussed on the screen. This will be the focus: we will suppose 16 in. Now, F 32 means $\frac{1}{32}$ of 16 in., which is $\frac{1}{2}$ in., therefore a stop $\frac{1}{2}$ in. in diameter is with the 16 in. lens F 32, and so on with regard to any lens or any stop that may be used. Again, suppose our lens has a back focus of 6 in.: for convenience we divide the 6 in. into $\frac{1}{16}$, which we find to be $\frac{96}{16}$; therefore, $\frac{6}{16}$ in. being made the diameter of the opening of the stop, we have at once F 32, and so on with any lens or stops, we have to calculate the length of focus, to be divided by the diameter of the stop to find its proper designation.

In picture-making by photography it is a good rule never to use a smaller stop than is absolutely necessary to give *proper* definition, and in copying work, use a very small stop in order to get the *utmost definition and flatness* obtainable.

In the diagrams appended the positions of the stops are shown, with the resulting effects.

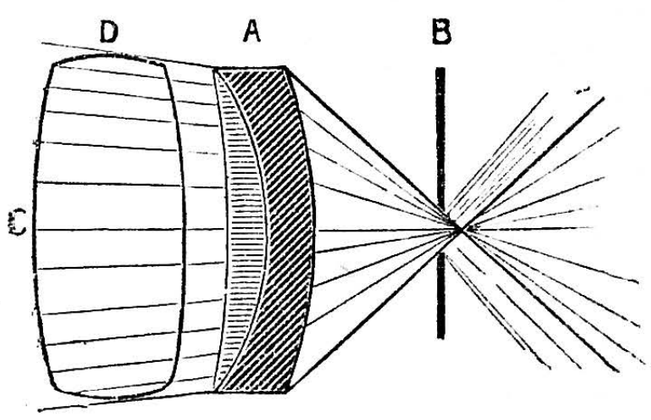

Fig. 1

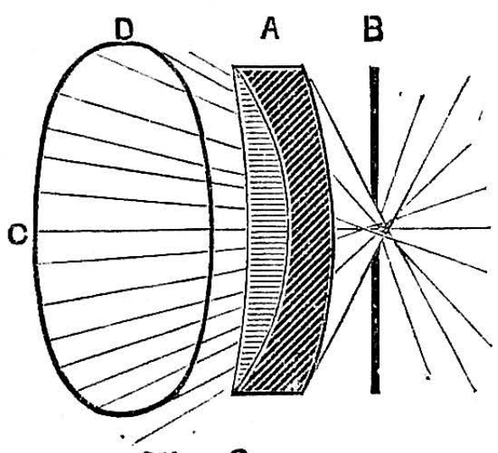

Fig. 2

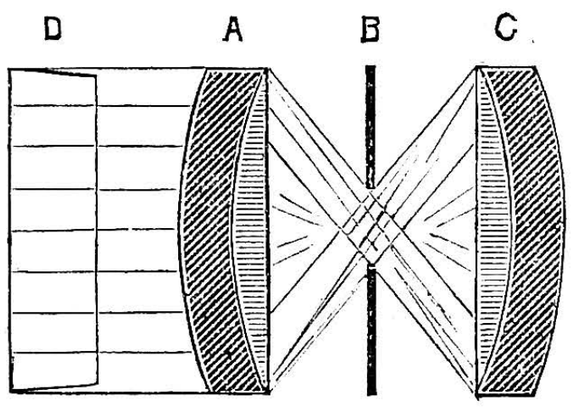

Fig. 3

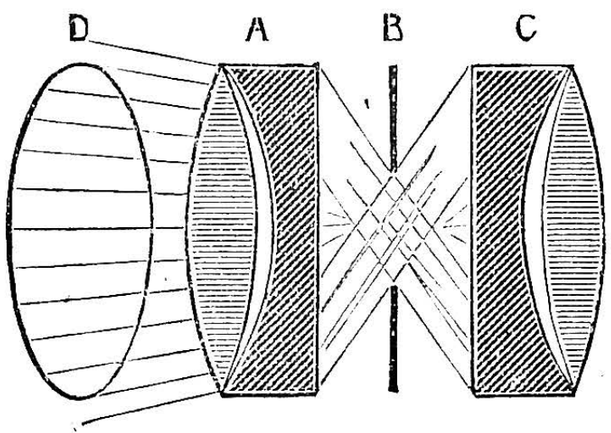

Fig. 4

Photographic Lens. Fig. 1.—A, Lens; B, Stop at a distance in Front; C, Rays of Light forming Image; D, Showing distortion of Straight Lines. Fig. 2.—A, Lens; B, Stop close to Lens; C, Rays of Light forming Image; D, Showing greater distortion of Straight Lines. Fig. 3.—A and C, Rectilinear Lenses; B, Stop; D, Showing Straight Lines as they should be. Fig. 4.—A and C, Portrait Lenses; B, Stop with large opening; D, Showing roundness of Field.

SCIENCE TO DATE.

Calculation.—Another individual whose calculating powers are similar to those, already described in this column, of the young man presented at the French Academy, has turned up in America. Reuben Field is a native of Missouri. He is a man forty-five years of age, who has never been to school, having always been considered an idiot. He does not know how to read or write, and his intelligence is below the average, but in spite of this he has the keenest perception of relations between numbers, and can solve the most complicated calculations very quickly. Another peculiarity he possesses is the faculty of stating the exact time at any moment, even during the night after a prolonged sleep.

Caoutchouc.—In the district of the higher Orinoco have been discovered immense virgin forests of caoutchouc trees, which are said to furnish a superior product to that of Para. A curious point is that amongst the different varieties of caoutchouc trees found in the upper courses of this river there are some which appear identical with those of the Malay archipelago.

Gilding Aluminium.—It is impossible to silver or gild aluminium by the ordinary processes, by reason of the chemical action of this metal on solutions of the cyanides of silver or gold. It can, however, be done if the aluminium is first covered by a thin coating of copper. This may be effected by first rubbing the aluminium with emery, dipping in soda ley till hydrogen escapes all over the surface, treating with concentrated nitric acid, and then placing it in a solution of sulphate of copper, to which nitric acid has been added.

Carbide of Silicon.—A compound of the composition SiC has been recently prepared by long heating of silicon mixed with silica in carbon crucibles. The product of this action is heated first with caustic potash, which dissolves the unchanged silicon and some of the silica, and then with hydrofluoric acid, by which all the remaining silica is removed, together with some other impurities. Silicon carbide—SiC—is thus left as a clear green pulverulent residue. It is infusible, and at a white heat becomes converted into SiCO.

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TRADE: PRESENT AND FUTURE.

*** *Correspondence from Trade and Industrial Centres, and News from Factories, must reach the Editor not later than Tuesday morning.*

TAILORING TRADE.—At Newport (Mon.) union men are locked out, and the employers express themselves determined to fight the exclusive workshop system. The lock-out in the Manchester tailoring trade is not general. In Liverpool, Newcastle, and Bradford only a few men are affected. London will not join the movement.

ENGINEERING TRADE.—There is a distinct improvement in the condition of the Lancashire engineering trade. Large stationary engine makers have secured good orders, while orders for locomotives have been placed in this district. Boiler makers report an improvement. No improvement is reported in the Mersey shipbuilding trade, but at Barrow shipbuilders are fairly busy. The returns of the Amalgamated Society of Engineers for the past month show a slight increase in the number of unemployed. As there is a fair demand for pattern makers, it may be taken that a fair amount of new work is coming forward. In the Steam Engine Makers' Society the number of unemployed is still about 2½ per cent. The iron trade of the district has now a stronger tone in some departments.

SILVER TRADE.—Better prospects prevail, and Sheffield houses who combine the manufacture of cutlery with that of silver are reaping the benefit of the strike at Messrs. Rodgers'.

MARINE IRON TRADE.—For general marine work trade has not been so bad for some years. Large numbers of ships are laid up for want of work.

FILE TRADE.—File workers of Sheffield are only working three days per week. This is one of the fruits of the new tariff in Spain and Portugal.

RAILWAY MATERIAL TRADE.—A few orders are to hand, and of late a number of indents from abroad have helped a fair home demand.

ARMOUR-PLATES TRADE.—The Sheffield armour-plate mills are engaged on English Government work.

CUTLERY TRADE.—The strike at Messrs. Joseph Rodgers & Sons', Limited, promises to be keen. Three branches of the trade are affected—forgers, grinders, and cutlers. The "team" system is the bone of contention.

TIMBER TRADE.—London sales have consisted of nearly every kind of wood imported into this country. Prices are unaltered—a parcel of pitch pine timber from Pensacola fetching from 33s. to 62s. per load; 1¼ in. by 6 in. 1st yellow flooring, 13s. 6d. per square; 1 in. by 6½ in. yellow flooring, 13s. per square; ⅞ in. by 6½ in., 7s. per square. Reports from the provinces show no great demand.

COTTON TRADE.—Operatives favour the adoption of the eight hours day in the cotton-spinning industry. Employers are of opinion that an Eight Hours Bill would result in the ruin of the Lancashire cotton trade. As yet, however, no organised attempt is being made by the operatives to reduce the hours of labour. The suggestion to reduce wages 10 per cent. has been abandoned by the masters, and a 5 per cent. reduction is now proposed, but some time must elapse before the opinions of the whole of the master cotton spinners can be obtained.

STEEL TRADE.—Important developments of the Staffordshire steel trade are in progress, and the Midland district will soon be independent of importations from Sheffield and the North of England.

COAL TRADE.—An immediate development of coal mining in the Ashton-under-Lyne district is expected to follow the important discovery of coal in that locality.

SHIPBUILDING TRADE.—Our Liverpool correspondent writes:—There is no alteration in the shipbuilding trade. Everything remains very quiet; the freight market continues to be depressed, but there is a slight improvement for freights from San Francisco, which will allow some of the Liverpool ships that have been lying idle at that port to come home. The grain shipments from America are so large that it is difficult finding storage room, and some of the enterprising merchants have been inquiring upon what terms owners of idle vessels will let them for wheat storage. Negotiations are in progress to bring about the termination of a dispute between ship-carpenters and ship-joiners employed in the Aberdeen building yards.

JEWELLERY TRADE.—The London trade is still stagnant to a degree—holidays and departures from town being the chief cause. Next season we hope the coming royal wedding will put West End jewellers on better terms with themselves.

SHOP:

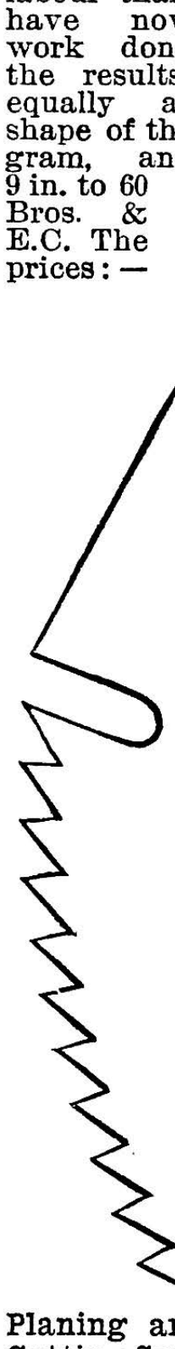
A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

I.—LETTERS FROM CORRESPONDENTS.

Circular Planing Saw.—A. J. H. (*Brixton*) writes:—"In answer to several correspondents who have written about the new circular planing saw, I have delayed the reply until I could satisfy myself that it could do what the manufacturers state it can—*i.e.*, 'cut and plane all kinds of wood by the same action as an ordinary circular saw, producing a beautifully smooth surface equal to hand planing, with little additional power and no more labour than is required for ordinary sawing.' I have now seen the saw and some work done by it, and am surprised at the results. It will plane cross cuts equally as well as deep cuts. The shape of the saw is shown in the diagram, and can be had in sizes from 9 in. to 60 in. of Messrs. Sanderson Bros. & Co., 101, Leadenhall Street, E.C. The following are some of the prices:—9 in., £4; 12 in., £4 10s.; 18 in., £5 10s.; 22 in., £6 10s.; 30 in., £8. Those readers of WORK who require one can, by mentioning this paper, be allowed a discount of 10 per cent. I shall be pleased to show the saw at work to anyone interested. The Editor has my address."



Planing and Cutting Saw.

Deck Fittings.—A CRAFTSMAN writes:—"Most of these can be procured at Stevens' Model Dockyard, to which place intending boat-builders should send for a catalogue. The fittings represented by Figs. 7 and 12 (p. 155, Vol. IV.) will have to be made by the boat-builder, as I do not think they can be procured ready-made. Capstans, binnacle, ship's boat, ship's bells, cleats, small skylights, etc., can all be procured of various sizes at the Model Dockyard. Skylights large enough for a four or five-foot boat must be made, as they are only kept in stock of such sizes as are suitable for three-foot boats."

Tramcar.—A. J. P. (*Manchester*) writes:—"Seeing in No. 173 that a tramcar worked by ammonia was being tried in America, it may interest your readers to know that the same sort of tram is being experimentally run at Moses' Gate, Bolton, near Manchester. If it proves a success, it will run from Moses' Gate to Bolton instead of the horse tram."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Text-Book on Electricity.—P. L. (*Selly Oak*).—"Elementary Lessons in Electricity and Magnetism," by Silvanus P. Thompson, price 4s. 6d., is one of the best books on the subject for a beginner, because the lessons given therein are simple and sound. You did well to repeat your question in your second letter, but must not expect an answer to it in three weeks from date. The reason for this delay has been frequently given by our Editor in "Shop."—G. E. B.

Model Yacht.—J. E. W. (*Islington*).—J. E. W. asks too general a question for me to answer. If he gives the size of his model and the kind of rig he wishes, I will send him the proportions that the masts, sails, spars, etc., should be, as they will differ very much for a cutter, schooner, yawl, or lugger, each rig requiring spars, sails, etc., of various measurements. Send what you require, and I will at once reply; but I must first have description of rig and model.—L. Y.

WORK, Vol. I.—L. H. (*Bolton*).—Vol. I. is out of print, but if you watch the "Sale and Exchange" column you will sometimes see one offered for sale; or you can advertise therein for the volume. The published price of each volume of WORK is 7s. 6d. Glad to hear you think so well of the publication.—ED.

Watch Tools.—WATCH.—Catalogues of watch tools can be obtained from any tool dealer's—as a rule, without charge if a trade card or bill-head is sent with the application for one. Any of the following firms will, I expect, send you an illustrated catalogue if you write: Gray & Sons, Clerkenwell Green, E.C.; Plucknett & Co., Poland Street, W.; or Grimshaw & Baxter, Goswell Road, E.C. If you are not in the trade, and will send to the Editor, I will see what my influence will do towards getting you one.—H. S. G.

Electric Alarum.—L. C. (*Maidstone*).—You will find a full illustrated description of an electric time alarum in No. 32, p. 497, Vol. I., of WORK. Several other designs for alarums were given in Nos. 40 and 48, pp. 636 and 763, Vol. I., and in pp. 157, 175, 226, 416, 582, 699, and 723, Vol. II., of WORK. A continuous ringing electric bell, suitable alike for a time alarum or a burglar alarum, was illustrated and described in No. 20, p. 312, Vol. I., of WORK.—G. E. B.

Stain for Drawers.—A READER OF "WORK."—The light oak appearance of the wardrobes and bedroom furniture, as seen in the shops, is not done by the usual stains, as used by French polishers—it forms a trade by itself. You will find full particulars of "how it is done" on referring to "Graining Cheap Furniture," p. 187, No. 116, of WORK, Vol. III., June 6th, 1891.—LIFEBOAT.

Black Lacquer.—LACQUERER.—Mix lamp-black, gold size, and turps to the consistency of thin cream, and apply with a camel-hair brush. Should it rub off on drying, add a little more gold size. Chemical black: Make a strong solution of nitrate of silver, and also of nitrate of copper, mix, and dip the articles in it, and heat over a gas flame till the required blackness is obtained.—R. A.

Incubator.—ONE IN A FIX.—I cannot say definitely why your regulator and thermometer will not work in unison, but, judging from your letter, I should imagine you have failed to fix these fittings in their proper places. Possibly the J tube is not fixed quite high enough; vary its position and note results. You will also do well to read up that part of the original article dealing with this portion. If you follow the instructions there given, and have made fittings as described, or obtained them from Mr. Stevens, they cannot fail to work satisfactorily.—LEGHORN.

WORK Volumes.—A. G. (*Lambeth, S.E.*).—Some of these are out of print. They cost 7s. 6d. each, bound. You should advertise for any you want in WORK, or write to Cassell & Company, London, E.C.

W. C. Connection.—SHARP.—If you write to Kemp, Coldharbour Lane, Brixton, London, he will furnish you with all particulars. Kindly mention WORK.

Carpentry Tools.—AMATEUR.—For tools, you cannot do better than apply to Melhuish, Fetter Lane, London, or others advertising in WORK.

Glass Blowing.—TWIX.—As soon as a capable writer submits the subject to us it shall receive attention.

Analytical Chemistry.—STUDENT.—We intend to deal with this. Make it known.

Bicycles.—D. B. D. (*Penryn*).—Our correspondent is now in Liverpool. You had better write to the Patent Office, London, E.C.

Gum for Envelopes.—AGRICOLA (*Gartly N.B.*).—The gum used for envelopes, as also for postage-stamps, is, I believe, dextrine. It is made from starch by treatment with acid or diastase, and is much cheaper than gum-arabic. It can be bought as a powder at the chemist's, and dissolved in water.—M. M.

Telescopes.—W. H. (*Chorley*).—Some short illustrated papers on the hand-working of glass speculæ for the Newtonian telescope, which were commenced in No. 160 of WORK, and are now publishing, will give you the information you want.—E. A. F.

Engine.—NO NAME.—Many models are made without "pet cocks," which is the correct term, but they ought to be put on a cylinder of 3 in. by 2 in. size; if not, there will be accumulations of water at the bottom.—J.

Smithing.—ASPIRANT.—As regards your trade, there is no literature worth naming. There are four small volumes on "Blacksmithing," published by M. T. Richardson, New York, which it would be worth your while to get. You can get them of Trübner, Ludgate Hill, E.C., at 5s. each. There is also a very elementary work, entitled "The Smithy and Forge," published by Crosby Lockwood, Stationers' Hall Court, at 2s. But I should advise you to take a range of reading much wider than this. I should study generally engineering and metallurgy. I hardly know what books to recommend, there are so many good ones. Supposing you take the following:—Holmes on "The Steam Engine," price 6s., published by Longmans, Paternoster Row; "The Strength of Materials and Structures," by Sir John Anderson, also published by Longmans, at 3s. 6d.; "Metals: their Properties and Treatment," by C. L. Bloxam, also by Longmans, 3s. 6d.; "Steel and Iron," by W. H. Greenwood, published by Cassell & Co., E.C., at 5s.; "Practical Iron Founding," by myself, published by Whittaker & Co., at 4s. Look out for Cassell's New "Technical Educator" articles.—J.

Iron Rivets.—W. H.—You can get rivets of the Phœnix Bolt and Nut Company, Handsworth, near Birmingham.—J.

Bent Iron Work.—AN OLD SUBSCRIBER.—You can get the bent iron of Whiteley, Westbourne Grove.—J.

Institution of Engineers.—M. J. M. E. (*Kirkdale*).—The qualifications neeessary to enable a

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man to become a member of the Institution of Mechanical Engineers are entirely of a practical character. Besides members, there are graduates, associates, and honorary members. According to the articles of the bye-laws: By article 2, "Candidates for admission as members must be engineers not under twenty-four years of age, who may be considered by the Council to be qualified for election." By article 3, "Candidates for admission as graduates must be engineers holding subordinate situations, and not under eighteen years of age; and they may afterwards be admitted as members at the discretion of the Council." By article 4, "Candidates for admission as associates must be gentlemen not under twenty-four years of age, who, from their scientific attainments or position in society, may be considered eligible by the Council." By article 5, "The Council shall have the power to nominate as honorary life members gentlemen of eminent scientific acquirements, who, in their opinion, are eligible for that position." A recommendation for admission to the Mechanical Engineers must be signed by not less than five members, and forwarded to the secretary, who will then submit it to the Council for their approval. It is then inserted in a ballot-box approved by the Council, and signed by the president, and forwarded to the members for election or otherwise. The form of proposal is as follows: "Mr. —, being not under twenty-four years of age, and desirous of admission into the Institution of Mechanical Engineers, we, the undersigned, proposer and seconder, from our personal knowledge, and we, the three other signers, from trustworthy information, propose and recommend him as a proper person to become a member thereof. Witness our hands this day of . Signatures of members." The proposer and seconder must write from personal knowledge of the candidate. The remaining three may write from trustworthy information, without personal knowledge. The ballot lists sent out to members specify the name, occupation, and address of each candidate, and by whom proposed and seconded. These lists are opened only in the presence of the Council on the day of election by a committee appointed for that purpose. When the candidate is elected, the secretary gives him notice of the fact, and he is then required to pay his entrance fee and his first annual subscription, and also to sign a form expressive of his loyalty to the regulations of the institution. The entrance fee is £2, and the annual subscription £3. Any further information you may require may be obtained of the secretary, Alfred Bache, Victoria Chambers, London, S.W.—J.

Water Supply.—PUMP.—As your water is to be drawn from a well, it must be pumped up. If the well is sunk near a shed, your cheapest way to get the water will be to use an ordinary plunger forcing pump, driven by a hand crank, for the small quantity you want—twenty gallons a day is very little if it is to supply your house, for we reckon at least twenty gallons a day for each inhabitant. However, I should not advise you to sink a brick well; a tube well would be better, and the pump then could be fixed on the top, and the cost of sinking would be very little. These tube wells are the same as those used in Abyssinia, and I have found them very successful in small holdings in the valley of the Thames.—F. C.

Leaky Roof.—PUMP.—On the next course of brickwork above the line of your roof, you should pick out the "pointing"; then flash the roof with strips of zinc bent over and forced in between the brick courses; then repoint the brickwork joints with lime mortar; you can leave the flashing straight on the roof with an overlap of five inches, but fasten it to the tops of the corrugations, about every ten inches, with galvanised rivets. *Do not use copper rivets.*—F. C.

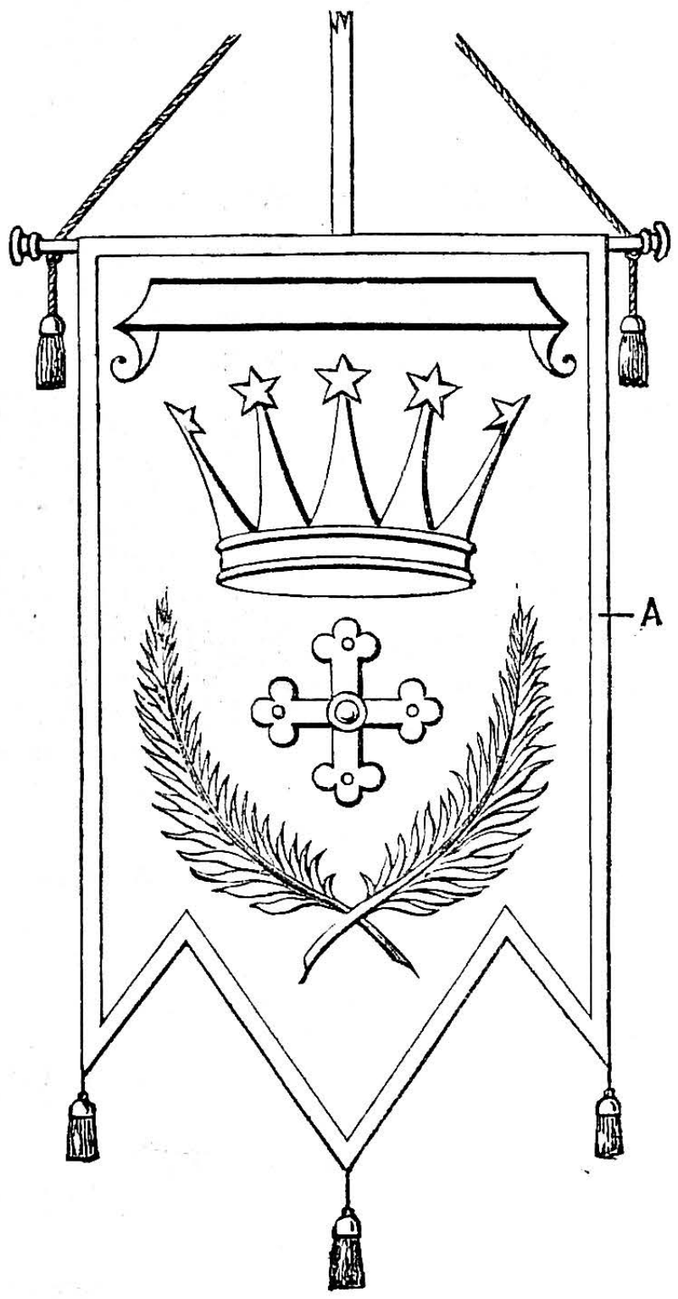
Piano.—MECHANIC.—Take out the backing of piano, and examine carefully, and see that the glue has not started in any of the joints behind the wrest-plank and bent side. If this has occurred, you must glue and put some bolts or screws in; if it is only the wrest-pins loose with frequent turning, you must replace these with a size larger, which you can obtain from W. Hughes & Co., 37, Drury Lane, London, W.C. If the wrest-plank is split where the wrest-pins enter, it will require a new wrest-plank.—T. E.

Piano Questions.—W. H. E. (*West Hartlepool*).—Bone is not used for piano keys, though I have seen it used for German harmonium keys; ivory and celluloid are used for piano keys. You could obtain these from a manufacturer of keys; but I cannot tell from your letter whether you require these for repairing purposes or making. I may say it is an awkward job laying ivory, unless you have had experience. You can obtain the ivory, strings, and wrest-pins from J. & J. Goddard, 68, Tottenham Court Road, London, W.C. The best wood to make a sound-board is Swiss pine, but a good substitute is spruce of first quality. The sound-board has no open space in it. Obtain index to Vol. I. of WORK from Cassell & Company, and read articles on "How to Make a Piano"; you will obtain information as to sound-board.—T. E.

Pianoforte Making.—B. J. (*Bingley*).—If you will obtain Vol. I. of WORK from Cassell & Company, or through your bookseller, and read articles on "How to Make a Piano," you will obtain all the information you require.—T. E.

How to Make a Door.—B. H. R. (*Cardiff*).—If B. H. R. will read *below* for *above* in the sentence "find the centre of height of door, and 1 in. *above* the centre square across the top of the middle rail" (see page 629, No. 144), I think he will acknowledge that this makes matters very much better; and if, in addition to this, he is told that the article referred to was an answer to a question where the door required would not be more than 6 ft. 6 in. high, I think his well-founded criticism will be met.—E. D.

Making a Small School Banner.—A. M. (*Glasgow*).—As you give no idea of the kind of device you require, I shall perhaps help you best by giving a sketch of a banner made by me for some St. Stephen's schools, and describing the method of making it. The ground was a very finely twilled silk, called "bishop's purple"—one yard silk; usual width; cost, 11s. The devices on it were in oil paint and gilding. The silk having been shaped, and the outline of the devices drawn on cartridge-paper and pricked through, the pattern was pounced upon the silk. The parts to be covered were then sized with a fairly strong solution of isinglass full up to the outline, and the little pounce spots mixing with the size made the outline sufficiently visible. When dry, the crown, except the stars, was laid in with gold-size, and gilt when properly tacky; then the stars were sized and silvered with silver-leaf. The crown is, of course, symbolic of Stephen—



School Banner.

Stephanos, a crown. The remaining devices were painted in tube oil colours, freely mixed with varnish as a medium; the cross, vermilion; the palm, green; the lettering, blue, with red initials, on a buff ribbon; all devices being shaded and lined with deeper shades of their own colours. The legend, not given in the drawing, was "*Ecc. S. Stephani.*" The border, A, was sewn on; the cord carrying tassels was a twist of three colours; and the pole was of oak, with a brass finial. The devices might be embroidered instead of painted, if time were no object; or a quicker and cheaper way in which to get up a banner would be to use simply calico, and paint the ground colour and devices in distemper. Gilding can be done on this. There is another way in which I once made an effective banner of the "Creation." Seven medallions were cut out in white silk; in the centre one was painted the church to which the schools belonged, and the other six bore emblems of the six days of creation. These were sewn on to a ground of suitable coloured material. Or, again, devices may be simply cut out in one coloured material and sewn on another, all painting being dispensed with. I have made banners of the "cardinal virtues"—thus, "Prudence" among these was very effective. It was a "humble-bee"—the body black velvet with yellow bands, the wings a light brown stuff, and the eyes gold paper, all sewn on. These are all alternative plans; but for a really fine banner nothing will equal the first.—S. W.

Safety Bicycle.—T. C. (*Birmingham*).—Articles on the Safety Bicycle appeared in WORK, Nos. 107, 111, 115, 119, 124, 127, 132, 137, and 142.

WORK Volumes.—ANXIOUS.—Volume I. of WORK is out of print; Vol. II., price 7s. 6d.; post free, 8s. 3d. Send postal order to Cassell & Co., London.

Maguay Electric Lamp.—J. M. & Co. (*London, E.C.*).—This can be obtained of the Secretary, Sherborne Electrical Installation Company, Dorset.

Naturalists' Papers.—TAXIDERMIST.—Thanks for your letter. When a thoroughly competent writer comes before us, we intend to give space to this subject.

Umbrella Stand.—G. H. (*Stockton-on-Tees*).—A design has appeared in No. 175.

Fire-box.—F. W. R. (*Sunderland*).—I think the proportions will do; but there is generally trouble with these small boilers, the difficulty being to keep up sufficient pressure of steam.—J.

Incubator.—H. J. (*Blackburn*).—For size of one-hundred-egg machine, see my reply to J. B. N. (*Lancashire*). Thanks for your offer. If you would like full-size drawings, please write to the Editor.—LEGHORN.

Dialling.—A. R. (*Moseley*).—The difference between sun and clock for each day is given in "Whitaker's Almanack" (London: Whitaker & Son, Warwick Lane, Paternoster Row, E.C.).—A. Y.

Plumbing.—PLUMBER.—Before you see this probably the plumbing papers will be with the printer awaiting publication.

Rubber Solvent.—C. E. S. (*Taranaki*).—Benzene is a good solvent for indiarubber, also sulphide of carbon. It may also be dissolved by naphtha, spirit of turpentine, and chloroform; these solvents will not destroy its elasticity.—A. S. P.

Tire Cement.—A CONSTANT READER.—I have no recipe for making these cements, as it is not worth anybody's while attempting to make them in small quantities. Cement for fixing tires to iron rims can be bought at 1s. per lb. or in 6d. boxes; solution for mending tires or joining rubber to rubber can be had for 6d. and 1s. per bottle; both of any cycle dealer.—A. S. P.

Astronomy and Chemistry.—READER FROM THE FIRST.—Our staff is already a large one, and much matter awaits publication, but the subjects of astronomy and practical chemistry shall be dealt with as soon as some really attractive papers are submitted to me.—ED.

Lathe for turning Elliptic Sections in Metal.—D. R.—I do not see why the ordinary oval chuck should not be made strong enough to do such work. If the work were long, there could be a second oval chuck attached to the poppit, so as to carry the other end, and this second chuck would be turned by the work itself, or might have an independent motion communicated to it. There is a lathe invented by Messrs. Koch & Müller. This is very ingenious and rather complicated, and would require a whole page of WORK to make at all clear. The principle is that of the French oval chuck, in which there is no ring, but a mandrel within the ordinary one, and a short cross slide in the face-plate. In the German lathe, however, which is intended for metal-work, the inside mandrel may make any proportional number of revolutions compared with those of the main mandrel, so that not only ellipses, but three, four, or more lobed sections can be produced. I do not know how such work as this is actually done in practice, but if I wished to turn the oval flanges of a quantity of brass stuffing glands, I should prefer to use the principle of the copying lathe. Have one pattern flange made, and fit it on a kind of back shaft, so as to make equal turns with the mandrel; then take out the screw of the cross or traversing slide of the saddle, and fix a rubber or roller upon this slide, to press upon the revolving pattern and be kept up to it by a weight; this would cause the cross slide to move in and out twice in the revolution. I would use a milling cutter instead of a tool, and have the roller on the pattern of the same diameter; thus the lathe would turn very slowly, and one revolution would complete the work. See also Northcott's "Multi-purpose Lathe," in his "Lathes and Turning."—F. A. M.

Window Sashes.—R. A. DE N. (*Kensington*).—If a simple plan for reversing ordinary window sashes could be devised without infringing on one of the many patents that already exist, the very fact of its being unlike any other would cause the inventor to patent it at once, especially if it could be done very cheaply, as you desire. There are a great many wonderfully ingenious inventions for combining sliding with reversible sashes, but, as you have found out, they are more adapted for new than old sashes. The especial patent to which the article mentioned refers is a Mr. Hough's, of 135, Great Suffolk Street, Southwark, and he claims for it that *existing windows can be adapted to this principle in a few hours at a small cost.* It was the fact of its being easily adapted to existing sashes and its practicability that caused it to be noticed.—E. D.

Electricity Examination.—A. W. (*Lynmouth*).—Write to the Secretary, Central Institute, Science and Art Department, South Kensington, enclosing a stamp, and ask for a prospectus. From this you will learn how to proceed in studying for an examination in electricity and magnetism. Lists of questions are published by the same department for a few pence each copy. Each year, for several years back, has its own list, and the price of each full list, containing all the questions in full, is 6d. The Science and Art Directory, price 6d., gives full

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instructions respecting the course of study for examinations. Both Guthrie's and Thompson's books on Electricity and Magnetism may be studied by you with advantage.—G. E. B.

Balance Staff to Lever Watch.—HOROLOGY.—I scarcely know how to answer this query, which seems so simple, but which to do, even to one that gets such a job once a week, is not easy, if it is to be done as it should. However, the tools necessary are: First, a lathe or turns, a graver, screw ferrule, bow, pivot file and burnisher, one or two bell-metal polishers, a little oil-stone dust, and diamantine for finishing, a douzième gauge or pinion gauge for measuring the length, etc. To begin, take out the old staff, take off the roller and hair spring, and knock the balance off the staff, keeping it for measurements. Now get a needle slightly larger than the body of old staff; let the temper of it down to a blue. Get a little piece of brass, and drill a hole through it rather smaller than the needle, and drive it in tight. Now file it off half as long again as the old staff, and file centres on its ends. Put on ferrule, mount it in turns, catch the brass true, and square the shoulders. Now turn the steel down till the roller begins to go on, then mix a little oil-stone dust with a little oil; put a little on your polisher, and grind it down till roller will almost go up to the brass collet. Carefully clean off all oil-stone dust. Take another polisher, mix a little diamantine and oil, and repeat grinding till roller is just free of the collet; then finish with the burnisher. With the pinion gauge measure from roller to seat for balance, and fit it on tightly; do the same for the hair-spring. Gauge from balance-seat or roller-seat to whichever pivot is left on, and turn new one a very little longer. Turn it to the proper shape and nearly to size, then finish with file and burnisher till it fits the hole nicely, and comes through far enough to rest on the endstone. Now take the measurement outside both holes, and turn the remaining pivot to agree to this measurement, allowing a little for rounding up the pivots when all is done. Now rivet on the balance, and see it is running flat and true; if it does not, you must make it by bending the arms. See also it is in poise—that is, that one part of the balance is no heavier than the other—else your watch will vary in position. Put on your roller, and see that it is true and flat, and then place your hair-spring in position, and put watch in beat by adjusting the hair-spring or the roller. This is a rough outline for a common job, but it is difficult to give instructions on paper for a delicate job like this. Besides, in your query you do not say whether it is for a full plate or three-quarter plate, over-sprung or under-sprung, plain or compound balance: each requires a little different way of working in. Neither do you say which pivot is broken, or whether the old staff is a brass collet or a solid steel.—A. B. C.

Clock Movements.—J. H. R. (*Sheffield*).—J. J. Stockall, Clerkenwell Road, London, imports all kinds of American movements, and I daresay will supply you with one; or you can obtain any you require from C. Churchill & Co., Cross Street, Finsbury; or Mr. Cohen, Kirkgate, Leeds. In any case, a letter to either, enclosing stamped addressed envelope, will get you particulars; and for Seth Thomas' clocks and movements only, write to R. M. Marples, Cripplegate Buildings, Wood Street, London, E.C.—A. B. C.

Trade.—ANXIOUS.—You can go as an apprentice to a joiner till you are twenty-one; or you can go as an articled pupil to a builder, spending part of the time in the workshops and part in the office: in the former case you would receive a wage, in the latter you might have a premium to pay. You should also attend the science and art classes in the evenings, studying mathematics, geometry, building construction, mechanical or architectural drawing, and perspective. You might travel on your bicycle in the summer months, and go to lodgings in the winter, when you could attend the classes. I cannot give you any names; but by making inquiries, or by consulting a directory, you could ascertain the names of suitable firms; or if you know anyone in the building trade, they might be able to give you the name of a suitable firm.—M.

Mahogany Filling.—H. E. (*Eastbourne*).—Cover the mahogany with a thin paste of plaster-of-Paris in water. When this has set and is dry, rub the surface down with fine glass-paper held on a cork bung. Coat with boiled linseed oil, let this soak into the pores, then apply another coat: allow this to get firm, then commence with the French polishing. Mahogany stopping is merely white-lead putty tinted with red lead; it is used to fill up cracks in mahogany surfaces before "filling" and polishing.—G. E. B.

III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

Reversible Gas Alarm.—F. G. H. (*Torquay*) writes to D. B. (*Glasgow*) (see No. 172, page 252):—"Will you kindly inform me of the cost of fitting the above to your premises, and of maintaining the same, say, at per year; also how long you have had the system working, and whether you have seen it tested elsewhere?"

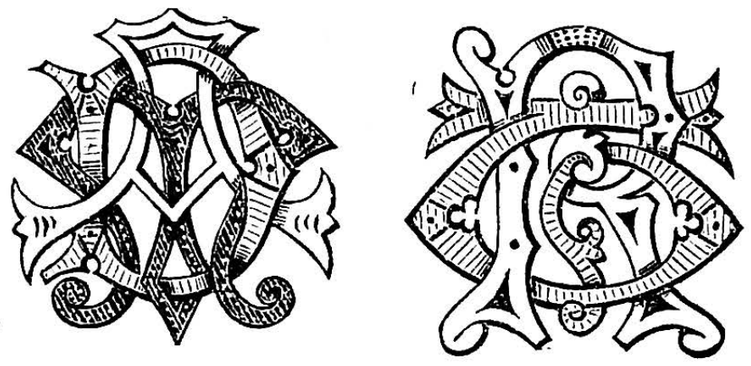
Firewood.—J. (*Penge, S.E.*) writes:—"Will any reader kindly give me information as to firewood making, bundling, etc.—how to buy the wood and materials, prices, etc.?"

Leather Belt.—VENO writes:—"I have a leather belt, which is made to revolve round two pulleys; it requires a smooth dry surface. I have varnished it with shellac varnish, but it cracks when it has been running a short time. Can any of your readers inform me if there is anything I could put in the varnish to prevent cracking?"

Parquet Flooring.—HERRINGBONE writes:—"Would any reader kindly enlighten me as to an effective, and at the same time inexpensive, way of fixing parquet flooring, ¼ in. thick, to an old underfloor of ordinary *deal*, and also to *stone* hall floor? I think at present glue is used in the first instance, and a mixture of asphalte, mastic, and tar in the second, but no doubt there is a cheaper and equally good way of fixing oak to wood floor than using glue only. Please tell me also the proportion of mixing the mastic tar. As I know that there are a good many parquet layers among your readers, the question will be of general interest."

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Fret Monograms.—T. B. P. (*Winlaton*) writes:—"Enclosed are two monogram designs — one



"A. M. D." and "R. T." Monograms.

'A.M.D.', in reply to C. H. D. (*Shepherd's Bush*); the other 'R. T.', in reply to R. T. (*Glasgow*). I trust they may be favourable to each."

V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A. N. (*Newark*); C. W. L. (*Newcastle-on-Tyne*); A. L. C. (*Camberwell*); CONSTANT READER; H. J. (*Prestwich*); V. D. (*Portsdown Road*); MAIL CART; WILGJB; HARDY PATENT PICK CO. (*Sheffield*); G. A. F. (*Pontefract*); R. A. (*Leeds*); A. L. C. (*Camberwell*); W. C. (*Wolverhampton*); J. D. (*Cheadle*); W. K. (*Manchester*); T., LIMITED (*Birmingham*); READER OF "WORK"; P. B. H. (*Southampton*); H. A. (*Thornhill Edge*); P. E. (*Birkenhead*); J. B. (*Weymouth*); W. D. (*Wellingborough*); R. P. W. (*Worcester*); T. J. H. (*Nuneaton*); FRAMEMAKER; J. H. (*Beith*); A. D. J. (*Notting Hill, W.*); F. K. (*Bradford*); W. W. H. (*Mirfield*); MAPLE LEAF; W. S. (*Liverpool*); J. S. (*Beith*); W. P. B. (*Birmingham*); AMATEUR PHOTOGRAPHER; A. F. (*Leicester*); OIL PAINTING; E. H. (*Dundee*); W. H. J. (*Halifax*); W. H. (*Nantwich*); J. T. (*Blantyre*).

NOTICE TO READERS.

AMONG the principal articles in next issue (No. 182) will be:—

SOMETHING NEW IN SINKS.
PHOTOGRAPHIC SCENERY PAINTING.
BOOT AND SHOE MAKING.
EARLY CHRISTIAN DESIGN AND ORNAMENT.
HOW TO FEED MODEL BOILERS.
WHAT THE GOLDSMITHS' COMPANY SHOULD DO.

*** The Editor makes this intimation in the hope that readers, having friends interested in any of these subjects, will bring the same to their notice.

"WORK" PRIZE SCHEME.

FOURTH COMPETITION.

"Tourists' Road, Water, or Rail, Travelling Requisite" Competition.

THE Briton who does not tour or travel when he can get the chance must be an exceptional individual. We meet with people bound, not only for the Continent, but for destinations quite near home, so loaded with packages that a hand-truck is needed to move them. Generally, the Englishman has good reason to wish he had not tried to be so comfortable, with his Noah's Ark of cumbersome oddments, and that he could condense the lot into a single package, to strap on his back or carry in his hand, so that he could at times label it and send it on by quick train or carrier, while he roamed a free man. Such a light, handy "hold-all," or outfit, might be suggested for an improved travelling requisite, or anything else more useful. To give zest to, and widen the field of original research, such an outfit might, for instance, combine with it some useful appliance to be used in case of emergency—such as life-saving, or in pleasure hunting while holiday bent. This we must leave to our readers' judgment, and feel sure that anything to make travel more enjoyable will be welcomed by the public and the readers of WORK who have to travel. By the time this announcement is made most of us will have had some experience of holidays and the pleasures (?) of luggage. For the three best suggestions for an "Improved Tourist's Travelling Requisite," the following prizes will be awarded—

First Prize, £3;
Second Prize, £2;
Third Prize, £1.

CONDITIONS AND RULES OF THE "TOURISTS' TRAVELLING REQUISITE" COMPETITION.

ALL Descriptions to bear the WORK Prize Coupon, cut from one of the numbers of WORK in which the Prize Scheme is announced.

Each Description to be signed with an original *nom de plume*, and to have the writer's real name and address securely attached to the manuscript in a sealed envelope.

Each Suggestion should be fully described in respect to its purpose, construction, and working, and, where possible, should be illustrated with a drawing of the article itself and its various parts, to elucidate the description.

A Suggestion not illustrated will have an equal claim in the competition, provided the description be sufficiently in detail to convey a full idea of the article suggested.

In the work of judging regard will be had to the practical nature and utility of the suggestions, and their prospective popularity.

The Prize Suggestions and Drawings, and any others, to be published, if desired by the Editor, in WORK, but the copyright thereof to remain with the authors.

Copies of MSS. and Drawings to be retained by the competitors, as in no case can the return of MSS. be undertaken.

The Editor of WORK will supervise the judging of the Suggestions, and the selection, or decision, as determined upon by him is to be final.

All manuscripts intended for the "Tourists' Travelling Requisite" Competition must be addressed to the Editor of WORK, c/o Cassell and Company, Ltd., Ludgate Hill, London, E.C. They must reach him on or before SATURDAY, OCTOBER 29, endorsed, "Tourists' Travelling Requisite" Competition.

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